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SELECTED  
WATER  
RESOURCES  
ABSTRACTS



**VOLUME 8, NUMBER 20**  
OCTOBER 15, 1975

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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,  
Office of Water Research and Technology, U.S. Department of the Interior



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The Secretary of the U. S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.



## FOREWORD

**Selected Water Resources Abstracts**, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by co-ordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Research and Technology  
U.S. Department of the Interior  
Washington, D. C. 20240

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**AN ANALYSIS OF RUNOFF IN AN URBAN AREA (IN JAPANESE),**  
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Maryland Univ., College Park. Dept. of Civil Engineering.  
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**A MODEL OF ONE-DIMENSIONAL PERCOLATION TO A WATER TABLE USING A COMPUTER SIMULATION LANGUAGE,**  
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**HYDROLOGIC RECONNAISSANCE OF THE WAH WAH VALLEY DRAINAGE BASIN, MIL-LARD AND BEAVER COUNTIES, UTAH,**  
Geological Survey, Salt Lake City, Utah.  
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**PROCEEDINGS OF THE WORLD METEOROLOGICAL ORGANIZATION/INTERNATIONAL ASSOCIATION OF METEOROLOGY AND ATMOSPHERIC PHYSICS SCIENTIFIC CONFERENCE ON WEATHER MODIFICATION.**  
World Meteorological Organization, Geneva (Switzerland).  
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**ON A METHOD OF FOG MODIFICATION BY PASSIVATION OF CONDENSATION NUCLEI,**  
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).  
For primary bibliographic entry see Field 3B.  
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**RAIN ENHANCEMENT - A REVIEW,**  
Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Cloud Physics.  
For primary bibliographic entry see Field 3B.  
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**SALT DRIZZLES EXTRACTED FROM UNSATURATED AIR LAYERS BY SEEDING WITH HYGROSCOPIC NUCLEI,**  
Universite de Bretagne-Occidentale, Brest (France).  
For primary bibliographic entry see Field 3B.  
W75-09952

**NUMERICAL SIMULATION OF CLOUD SEEDING EXPERIMENTS,**  
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences. H. D. Orville, F. J. Kopp, and K. G. Hubbard.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 81-99, 1974. 3 fig, 1 tab, 13 ref. NSF Grants GA-24647, GA-36910X.

Descriptors: \*Cloud seeding, \*Numerical analysis, \*Weather modification, Clouds, Winds, Water vapor, Rain, Ice, Graupel, Hail, Precipitation(Atmospheric), \*Model studies, Salts, \*Simulation analysis. Identifiers: Potential temperature, Cloud water, Salt seeding.

A two-dimensional time-dependent cloud model with 200-meter grid spacing covering an area 19.2 km square was used to simulate cloud seeding experiments. Atmospheric wind, potential temperature, water vapor, cloud liquid, rain, cloud ice, and graupel were the primary dependent variables. Extension of the model to deep convection was made by using a density-weighted stream function. The model was used to simulate a natural cloud, ice phase seeding of both light and heavy cases, salt, and combinations of seeding agents. It was found that the cases studied resulted in pessimistic conclusions which may be modified when more realistic conditions are included in the model. It was also concluded that cloud modeling may be used to help develop a more quantitative rationale for many cloud seeding experiments. (See also W75-09944) (Jones-ISWS)  
W75-09955

**THEORETICAL RESEARCH INTO ARTIFICIAL STIMULATION OF PRECIPITATION FOR FIGHTING FOREST FIRES,**  
Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Leningrad (USSR). D. D. Stalevich, T. S. Uchevatkina, and N. S. Shishkin.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 89-94, 1974. 7 fig, 5 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Forest fires, Cloud seeding, Model studies, Mathematical models, Rainfall, Cloud physics, Precipitation(Atmospheric), Silver iodide, Nucleation, Meteorology. Theoretical analysis.

Recently, the artificial stimulation of rain has become widely used in extinguishing forest fires in the Soviet Union. Convective clouds 2.0-2.5 km thick and more which are moving towards the fire are seeded. Two essential questions were theoretically solved: (1) the optimal expenditure of seeding agent to produce maximum precipitation, and

(2) the distance at which the cloud should be seeded so that the precipitation falls directly onto the fire. Curves and nomograms were presented to show the optimum seeding rates and the best location for the seeding relative to the fire. (See also W75-09944) (Sims-ISWS)  
W75-09956

**HAIL PROCESS INVESTIGATION AND HAIL SUPPRESSION ACTIVITIES IN THE U.S.S.R.,**  
Gidrometeorologicheskii Institut, Leningrad (USSR). High-Altitude Geophysics Inst. For primary bibliographic entry see Field 3B.  
W75-09965

**NATURAL 'HAILCORES' AND THEIR ABILITIES TO ESTIMATE THE EFFICIENCY OF HAIL PREVENTION SYSTEMS,**  
Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. P. Admirat.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 197-206, 1974. 5 fig, 2 tab, 8 ref.

Descriptors: \*Hail, \*Storms, \*Energy, Size, On-site investigations, On-site data collections, Weather modification, Cloud physics, Precipitation(Atmospheric), Meteorology. Identifiers: \*Hailcores, Hailpads, Hail collectors, \*France.

Preliminary results were described for studies of natural hailstorms in France. These studies have been carried out since 1971 in the 'Languedoc' Project, whose experimental field is situated in the viticultural plain of Languedoc near Montpellier. Hailpads and refrigerated hail collection boxes were used. The study of the distribution of the numbers and diameters of hailstones falling from natural storms shows that certain relations exist between these two parameters, the most important of which are: (1) the simultaneous variation of the total number of hailstones and their maximum diameter from one point to another, and (2) the inverse relation between the number of hailstones and their diameter at one point. These relations characterize natural 'hailcores' which are real areas of hail accumulation at ground level where all the energy of the rainfall is concentrated. Hailcores are probably the result of a 'dumping' of the accumulation zone in the storm cloud. From the natural distribution of the numbers and the diameters of the hailstones, the future structure of hailcores modified by seeding can be calculated and the criteria which will enable measurement of the efficiency of the hail prevention systems can be established. When hailcores are destroyed, hail prevention techniques will be successful. (See also W75-09944) (Sims-ISWS)  
W75-09966

**RESEARCH INTO HAIL-FORMING PROCESSES AND THE RESULTS OF ANTI-HAIL PROTECTION MEASURES IN MOLDAVIA,**  
Central Aerological Observatory, Moscow (USSR). I. I. Gaivoronsky, L. A. Dinevitch, and N. M. Zaichenko.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 217-223, 1974. 5 fig, 1 tab.

Descriptors: \*Weather modification, \*Hail, \*Rainfall, Cloud seeding, Climatology, Precipitation(Atmospheric), Storms, Atmospheric physics, Cloud physics, Meteorology, On-site investigations.

## Field 2—WATER CYCLE

### Group 2B—Precipitation

Identifiers: \*Hail prevention, \*USSR(Moldavia).

In Moldavia, a comprehensive investigation was conducted of the evolution, including the regeneration, of thunder- and hail-clouds both under natural conditions and when subjected to artificial modification. Moldavia is one of the areas of the Soviet Union in which intensive hail-forming processes take place fairly frequently. In an average year, 10% of the territory is affected by hail. An analysis was carried out of mean total precipitation during the warm half-years before protective measures were taken and during analogous periods after protection. This analysis showed that when large-scale anti-hail experiments were carried out, the amount of precipitation on the protected and control territories increased as compared with the long-term data series. Since 1965, there has been a marked reduction in the size of the hail-damaged area in the protected territory as compared with the pre-protected period, while in the control areas, during the same period the level of hail damage remained within its former limits. (See also W75-09944) (Sims-ISWS)  
W75-09968

#### SIMULATION OF THE NATURAL PROCESS OF HAIL FORMATION AND ITS TRANSFORMATION UNDER THE INFLUENCE OF ARTIFICIAL CRYSTALLIZATION,

Gidrometeorologicheskii Institut, Leningrad (USSR).

L. G. Kachurin, N. D. Artemyeva, A. I.

Kartsivadze, S. Stoyanov, and M. Tekle.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 231-237, 1974. 5 fig, 10 ref.

Descriptors: \*Weather modification, \*Hail, \*Model studies, \*Cloud physics, Mathematical models, Atmospheric physics, Cloud seeding, Supersaturation, Condensation, Temperature, Moisture, Crystals, Radar, Storms, Precipitation(Atmospheric), Meteorology.

Identifiers: \*Hail suppression, USSR.

Calculations for convection were performed on the basis of the jet theory in a stratified atmosphere. The influence of latent heat accompanying phase changes (during condensation, crystallization, coagulation of different-phase particles) on the convection velocity as well as on the temperature gradient, vapor supersaturation, specific liquid-water content, and horizontal extent of cloud was taken into consideration in the principal equations for convection with regard to flow inertia. The whole system of equations for a hail cloud consisted of 19 differential nonlinear equations of first-order and 29 algebraic equations which were solved by electronic computers. The processes of hail formation and its suppression by inducing crystallization are extremely complex. Only complete calculations concerning the in-cloud processes taking into account thermodynamic irreversibility and regenerative coupling between internal processes in clouds and convection parameters give an idea of the process as a whole. Seeding cannot be successful without correct calculations. The intensity of the process of hail growth, both natural and artificially transformed, proves to be highly dependent on one or two main factors under certain conditions. In this sense, the cloud, with respect to the hail growth process, proves to be metastable. Comparatively small changes in the parameters (temperature, the profile of temperature or wind) may result in radical changes in the hail growth process, i.e., they can intensify or reduce it. (See also W75-09944) (Sims-ISWS)  
W75-09970

#### REVIEW OF RECENT WORK ON HAIL SUPPRESSION IN BULGARIA,

Bulgarian Academy of Sciences, Sofia. Inst. of Geophysics.

For primary bibliographic entry see Field 3B.  
W75-09971

#### THE EXPERIMENTAL PROGRAM TO MODIFY HURRICANES,

National Hurricane Research Lab., Coral Gables, Fla.

R. C. Gentry.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 245-254, 1974. 5 fig, 1 tab, 11 ref.

Descriptors: \*Weather modification, \*Hurricanes, \*Winds, \*Cloud seeding, Wind velocity, Rain, Surges, Atmospheric pressure, Tropical cyclones, Storms, Model studies, On-site investigations, Silver iodide, Nucleation, Cloud physics, Atmospheric physics, Meteorology.

Hurricane modification experiments have been conducted in the United States since 1961, and recent experiments have been by Project STORMFURY, an interdepartmental effort of the Departments of Commerce (NOAA) and Defense (Navy and Air Force). Hurricane Debbie was seeded five times within 8 hours on 18 August 1969 and again on 20 August 1969. The maximum winds measured and recorded by highly instrumented aircraft flying at 3600 m decreased 30% from 50 mps before the first seeding on 18 August to 35 mps 5 hours after the fifth seeding. The maximum winds, which had meanwhile returned to the original levels, decreased on 20 August from 51 mps before the first seeding to 43 mps within 6 hours after the fifth seeding by about 15%. Calculations with hurricane models suggest that the proper area in which to enhance the heating in a storm is the area outside the radius of maximum vertical motion (the eyewall) which in a mature hurricane usually coincides with the belt of maximum winds. It was hypothesized that seeding in these areas will result in a new eyewall developing radially outward from the old one, a reduction in the maximum pressure gradient, a reduction in the maximum winds, and a reduction in the moving of the belt of maximum winds to a greater distance from the center. (See also W75-09944) (Sims-ISWS)  
W75-09972

#### DYNAMIC METHODS OF CONVECTIVE CLOUD MODIFICATION BY MEANS OF ARTIFICIAL VERTICAL JETS,

Institut Prikladnoi Geofiziki, Moscow (USSR). For primary bibliographic entry see Field 3B.  
W75-09973

#### ON THE POSSIBILITY OF THUNDERSTORM SUPPRESSION BY CHANGING THE NON-EQUILIBRIUM CRYSTALLIZATION POTENTIALS OF CLOUD WATER,

Vysokogornyi Geofizicheskii Institut, Nalchik (USSR).

L. G. Kachurin, H. H. Medaliev, and N. I.

Karmov.

In: Proceedings of the World Meteorological Organization/International Association of

Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva

(Switzerland), p 275-282, 1974. 4 fig, 8 ref.

Descriptors: \*Thunderstorms, \*Radiation, \*Electromagnetic waves, \*Radio waves, Radar, Atmosphere, Electricity, Lightning, Weather modification, Storms, Measurement, Electricity, Meteorology, Research equipment.

Identifiers: USSR.

An important condition for experiments on controlling the electrical activity of clouds is the availability of equipment for use not only during a storm but also at the pre-storm stage in convective cloud development. Some definite results have been obtained in this direction. A special installation that enables monitoring both storm and pre-storm stage in convective cloud development. Some definite results have been obtained in this direction. A special installation that enables monitoring both storm and pre-storm stages of a convective cloud was made in the High Mountain Geophysical Institute. This equipment was used in the study of electromagnetic energy radiation from clouds. In addition, the measuring apparatus includes an electrical fluxometer and a centimeter wave-band radar. During the final experiments, a ten-centimeter radar technique was used which enabled more accurate location of thunderstorm discharges. According to the nature of the radiation field, one may distinguish three stages in thunderstorm development: pre-storm, storm, and after-storm. These stages are distinguished by spectral distributions of radiation field intensity in terms of duration and frequency of pulse parcel radiation. Preliminary experiments on cumulonimbus modification at the pre-storm stage showed that it is possible to affect the degree of electrical activity and thus the radiation field. However, it is probably easier to intensify the storm activity than to reduce it. The experiments show that as the storm processes develop under natural conditions (or after artificial modification) the radiation field characteristics vary noticeably. (See also W75-09944) (Sims-ISWS)  
W75-09976

#### SOME QUESTIONS OF THUNDERSTORM LIGHTNING CONTROL,

Ukrainii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).

V. M. Muchnik, and V. A. Djachuk.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 283-288, 1974. 6 fig, 1 tab, 10 ref.

Descriptors: \*Weather modification, \*Thunderstorms, \*Lightning, Electrical coronas, Atmosphere, Climatology, Electricity, Cloud physics, Atmospheric physics, Meteorology, Electric fields.

Identifiers: Electric charges, Corona discharge, Lightning suppression.

The choice of a method of controlling thunderstorm electricity is predetermined by the nature of the processes involved in the formation of thunderstorm. A clear picture of current theories on these processes is a necessary prerequisite to selecting an appropriate method. All theories suggested three possible bases of electrification mechanisms; the ions of the atmosphere, contact potentials, and the atmospheric electric field. Further examination of thunderstorm electricity theories indicates that the mechanisms of ion electrification cannot produce the formation of electric charges and fields such as are observed in thunder clouds. If atmosphere pollution does contribute to the thunderstorm activity, the influence cannot be great. Therefore, it is considered that contact electrification mechanisms are not fundamental in generating thunderstorm activity and that modification efforts in this direction are not justified. Because of the high conductivity in thunder clouds, the process of formation and division of charges within them must be continuous and must be of great intensity. The mechanism which appears most likely to provide such a rapid formation and division of charges is the collision of hailstones and ice pellets with liquid drops in the electric field of a cumulonimbus cloud. To study the collective effect the corona discharge from a system of dischargers was investigated. This method may play an important role in the

## WATER CYCLE—Field 2

### Precipitation—Group 2B

process of suppression of the thunderstorm discharge development. (See also W75-09944) (Sims-ISWS)  
W75-09977

**THE EFFECT OF CHAFF SEEDING ON LIGHTNING AND ELECTRIC FIELDS OF THUNDERSTORMS,**  
National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.  
For primary bibliographic entry see Field 3B.  
W75-09978

**THE POSSIBILITY OF USING CHARGED BUBBLES IN CLOUD MODIFICATION,**  
Institute of Experimental Meteorology, Odninsk (USSR).  
O. A. Volkovitskii, and V. V. Smirnov.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 295-300, 1974. 5 fig, 12 ref.

Descriptors: \*Weather modification, \*Cloud seeding, \*Bubbles, Laboratory investigations, Drops(Fluids), Cloud physics, Atmospheric physics, Precipitation(Atmospheric), Meteorology.  
Identifiers: \*Charged bubbles, Electric charges.

The feasibility of cloud modification by charged liquid bubbles was discussed in 1965. The problem of the charged bubbles' interaction with a water aerosol is characterized by so-called intermediate Reynolds numbers (10-100). Thus, it is impossible to obtain an adequate estimate of the collection efficiency of cloud droplets by charged bubbles without theoretical studies of the phenomenon over this range of Reynolds numbers. The aim of this investigation was to study the characteristics of the charged bubbles' coagulation growth. On the basis of experimental data on collection efficiency, tentative estimates of the droplets' washout rate from stratiform clouds were obtained. The collection of cloud droplets by charged bubbles was studied by using two techniques: (1) obtaining data on the collection efficiency of monodispersed cloud droplets by a charged sphere-collector by simulating the process in a small wind tunnel, and (2) fog modification by charged bubbles in a cloud chamber 3200 cu m in volume. It was estimated that when a cloud 1 cu km in volume with a liquid water content of 0.3 g/cu m is modified, the required reagent amount is, according to the estimates, about 0.6 tons for bubbles and 3 tons for droplets respectively, for a time of 30-35 min. (See also W75-09944) (Sims-ISWS)  
W75-09979

**ON THE POSSIBILITY OF GENERATING DOWNDRAFFS BY INTRODUCING A HIGH CONCENTRATION OF COARSE AEROSOL PARTICLES IN THE ATMOSPHERE,**  
Vysokogorni Geofizicheskii Institut, Nalchik (USSR).  
For primary bibliographic entry see Field 3B.  
W75-09980

**THE EML 1973 FLORIDA AREA CUMULUS EXPERIMENT,**  
National Oceanic and Atmospheric Administration, Coral Gables, Fla. Experimental Meteorology Lab.  
For primary bibliographic entry see Field 3B.  
W75-09981

**THE ACQUISITION OF INFORMATION DURING ATTEMPTS AT WEATHER MODIFICATION,**  
Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.

For primary bibliographic entry see Field 7B.  
W75-09986

**CONVECTIVE CLOUD STUDY RESULTS APPLIED TO WEATHER MODIFICATION,**  
Sredneaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tashkent (USSR).  
A. D. Djouraev, and V. A. Eltsov.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 373-384, 1974. 5 fig, 2 tab, 7 ref.

Descriptors: \*Weather modification, \*Clouds, \*Climatology, \*Hail, Movement, Convection, Cloud seeding, Radar, Winds, Correlation analysis, Meteorology.  
Identifiers: \*USSR, \*Hail suppression, Cloud growth.

Radar observation of convective clouds and their modification with the aim of hail prevention have been carried out since 1969 in the northern part of Phergana Valley in Uzbekistan. Based on X-band radar observations and radiosonde data, certain cloud characteristics were obtained. Observational data for 1969-1972 were analyzed of hail-, shower- and non-precipitating clouds. This data satisfied the following conditions: (1) The distance between a cloud and the radar system did not exceed 30 km, because there would be a considerable error in the radar-echo height determined over longer distances due to the finite width of the radar beam directivity diagram. (2) The given cloud was not yet seeded with reagent. For hail-cloud modification, the reagent (AgI or PbIZ) was injected by rockets into the zone 0-3 km from the front right of the cloud base because there were updrafts in this area. Simultaneously, the reagent was introduced by 'Elbrus-2' shells into the upper part of the cloud just before the increased reflectivity zone at isotherm levels -9 to -20C. Modification undertaken in the Phergana Valley resulted in a rather high efficiency of anti-hail protection with a consequent benefit to agricultural activities in the protected areas. (See also W75-09944) (Sims-ISWS)  
W75-09988

**ON THE THERMODYNAMIC CRITERIA FOR THE INTENSITY OF CONVECTIVE CLOUD DEVELOPMENT,**

Bulgarian Hydrometeorological Service, Sofia. K. Stantchev, P. Boev, and R. Petrov.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 385-394, 1974. 4 fig, 10 ref.

Descriptors: Rainfall, \*Hail, \*Convection, \*Model studies, Clouds, Cloud physics, Winds, Moisture content, Cloud seeding, Weather modification, Meteorology, Thermodynamics.  
Identifiers: \*Bulgaria, Hail suppression.

Among the various mesoscale meteorological processes, convection plays the most significant role, especially where this is related to the formation of cumuliform rain clouds. A study has recently been started, based on certain relationships observed in the convective process, to investigate the role of the energy of instability in the development of convection, or more specifically, to find a relation between the maximum intensity of precipitation from a convective cloud and the total energy of instability in the appropriate layers of the atmosphere. The relation found shows that the total energy of instability in the layer between 700 and 500 mb plays a fundamental role in the process within cumuliform shower clouds and consequently in the intensity of rain from such

clouds. The influence of other factors on the intensity is comparatively small. (See also W75-09944) (Sims-ISWS)  
W75-09989

**A REVIEW OF METHODS TO EVALUATE PRECIPITATION MODIFICATION IN NORTH AMERICA,**

Illinois State Water Survey, Urbana. Atmospheric Sciences Section.  
For primary bibliographic entry see Field 3B.  
W75-09990

**ECONOMIC ASPECTS OF PRECIPITATION AUGMENTATION OVER THE GREAT LAKES,**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 6B.  
W75-09992

**RADAR CHARACTERISTICS OF CUMULONIMBUS CLOUDS DURING THEIR NATURAL DEVELOPMENT AND ARTIFICIAL SEEDING,**  
Akademiya Nauk Gruzinskoi SSR, Tiflis. Institut Geofiziki.  
A. I. Kartivadze, and T. G. Salukvadze.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 465-472, 1974. 5 fig, 3 tab, 5 ref.

Descriptors: \*Weather modification, \*Hail, \*Cloud seeding, \*Evaluation, Statistics, Cloud physics, Radar, Atmospheric physics, Meteorology.  
Identifiers: \*Hail suppression, \*USSR(Alazani Valley).

An attempt was made, based on several years' radar measurements, to make some physico-statistical evaluations of the results of seeding of hail-dangerous clouds in the Alazani Valley (the Georgian SSR) by using rockets with crystallizing reagents. Over a period of 7 months in 1972, 461 dangerous clouds were seeded over the protected area of 600,000 hectares in the Alazani Valley. Based on calculations, 105 hail cases had to be expected with practical reliability; in fact, there were only 10. Thus, the efficiency of seeding was expressed in the probable decrease of the number of hail cases by about 90%. Evaluations of this kind are performed every year and indicate the high degree of efficiency of seeding in the Alazani Valley. Physico-statistical analysis of the large amount of experimental material allows demonstration of the effect of seeding, expressed both in the change of the developmental dynamics of cumulonimbus clouds and in the decrease of the number of the hailfalls from these clouds. (See also W75-09944) (Sims-ISWS)  
W75-09996

**ON THE CHARACTERISTICS OF SINGLE-CELL SHOWERS,**  
Iowa State Univ., Ames.

H. C. Vaughan, and K. L. Rancourt.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 473-482, 1974. 7 fig, 3 tab, 9 ref.

Descriptors: \*Rainfall, \*Weather modification, \*On-site data collections, \*Iowa, Radar, Rain gages, Thunderstorms, Rain, Distribution patterns, Precipitation(Atmospheric), Cloud physics, Raindrops, Rainfall intensity, Rainfall disposition, Meteorology, Air masses.  
Identifiers: \*Showers.

## Field 2—WATER CYCLE

### Group 2B—Precipitation

The rainfall pattern of Iowa during July and August consists of air-mass showers and thunderstorms. This investigation was initiated in an attempt to answer some questions regarding availability of precipitable water and the efficiency of precipitation in a convective cloud and to better understand the natural precipitation process. All measures were made at the Kelly Farm Radar Facility located 5.7 km west-northwest of Iowa State University in an area of gently rolling farm land. The facility consists of two SCK-584 search radars, one of which has been extensively modified and modernized to operate as a short-pulse, high-resolution, 3.2-cm unit. Located 8.9 km north-northwest of the facility is a 23.3-sq km test area with 16 raingages in a square matrix. To obtain the complete history of a single-cell shower by using a raingage network, it would be desirable to have a larger and finer-spaced grid of raingages; i.e., at least 400 sq km with 441 raingages. The instruments used in this grid should be large-orifice, high-resolution, recording gages. In addition, a high-resolution, short-pulse radar to supplement the raingage network, would be desirable. The presence of high-intensity rain shafts within a single cell can significantly bias the raingage data, depending on whether the shafts pass in close proximity to a recording point and whether the horizontal movement of the shower is rapid. From the data available, it seems that even very intense and fast-moving showers would have a comparatively uniform precipitation pattern if it were not for their forward motion. Also, the variation in rainfall intensity within a cell increases with increased cloud top. (See also W75-09944) (Sims-ISWS) W75-09997

**PREPARATION AND PROPERTIES OF 'PURE' SILVER IODIDE AEROSOL,**  
Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire de Meteorologie Dynamique.  
For primary bibliographic entry see Field 3B.  
W75-09998

**CLIMATE OF MINNESOTA - PART VII - AREAL DISTRIBUTION AND PROBABILITIES OF PRECIPITATION IN THE MINNEAPOLIS-ST. PAUL METROPOLITAN AREA,**  
Minnesota Agricultural Experiment Station, St. Paul.  
D. G. Baker, and E. L. Kuehnast.  
Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 851, \$3.25 in paper copy, \$2.25 in microfiche. Technical Bulletin 293, 1973, 18 p, 25 fig, 14 tab, 12 ref. OWRT B-068-MINN(2). 14-31-0001-3901.

Descriptors: \*Minnesota, Climates, Precipitation(Atmospheric), Precipitation gages, Precipitation intensity, Rainfall disposition, Probable maximum precipitation, Cities, Areal.  
Identifiers: \*Minneapolis-St. Paul Metropolitan Area(Minn).

A study was made of the daily precipitation at 25 stations within a 30-mile radius of the Minneapolis-St. Paul airport from May-September for the 5-year period 1964-1968. The frequency of daily rains of 0.01 inch or more indicated by a single gage was about 35% while in reality the frequency was closer to 65%. The number of gages required for a 'true' sample varies from about 45 in May and June to 60 in July. The area of a rain was generally least in July and greatest in June. The maximum daily rainfall recorded equalled 7.98 inches and the greatest total monthly rainfall was 11.85 inches. Precipitation was lower at the airport site. (See also W75-14763) (Walton-Minnesota) W75-10009

**THEORETICAL PROBABILITIES OF PREDICTED OCCURRENCES AND AMOUNTS OF PRECIPITATION,**  
Florida State Univ., Tallahassee. Dept. of Meteorology.

T. A. Gleeson.

Journal of Applied Meteorology, Vol 14, No 4, p 466-470, June 1975. 4 fig, 2 ref. NSF Grant GA-32535.

Descriptors: \*Precipitation(Atmospheric), \*Model studies, \*Probability, Mathematical models, Equations, Statistics, Theoretical analysis, Dynamics, Atmospheric physics, Cloud physics, Meteorology.

Identifiers: \*Wind tunnels, Vertical wind tunnels.

In a statistical-dynamical study of the atmosphere, the dependent variables of the dynamic equations constitute the continuous coordinates of a phase space in which an ensemble of possible states develops with time, according to the equations. However, the prediction of precipitation requires upward, not downward, winds and saturated, not unsaturated, air. These dichotomous features introduce first-order discontinuities in the dynamics at the time of condensation. It was shown that these discontinuities do not prevent the continuous transformation of a model ensemble with time, so that theoretical probabilities of atmospheric states are still possible both before and after precipitation begins. By means of the probability calculus, a model was developed to predict a theoretical probability of precipitation occurrence. Examples were given to illustrate these methods. (Sims-ISWS) W75-10050

#### AN INVESTIGATION OF THE PREDICTIVE ABILITY OF SEVERAL EVAPORATION EQUATIONS,

California Univ., Davis. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 2D.

W75-10051

#### AN EXPERIMENTAL STUDY OF THE DETECTION OF ICE NUCLEI ON MEMBRANE FILTERS AND OTHER SUBSTRATA,

National Center for Atmospheric Research, Boulder, Colo.

G. Langer, and J. Rodgers.

Journal of Applied Meteorology, Vol 14, No 4, p 560-570, June 1975. 10 fig, 3 tab, 25 ref.

Descriptors: \*Instrumentation, \*Laboratory equipment, \*Nucleation, Clouds, Filters, Membranes, Silver iodide, Ice, Supersaturation, Humidity, Condensation, Laboratory tests, Meteorology, On-site investigations, Air pollution, Pollutant identification.

Identifiers: \*Ice nuclei.

An experimental study was made of a membrane filter technique for the detection of ice nuclei in which air of controlled humidity flows across the cooled membrane as opposed to the usual static thermal diffusion procedure. This is necessary to overcome water vapor losses to various sinks on the sample substrate; the procedure also makes it possible to observe the nucleation process directly by microscope. However, for very small nuclei such as AgI, even this flow system is not able to activate the nuclei. This is overcome by letting a puff of supersaturated air pass over the deposited aerosol, which should be on a water-repellent substrate, to promote vapor flow to the ice and condensation nuclei, rather than onto the substrate. At temperatures warmer than -12°C, the puff procedure is not necessary since the water vapor pressure is sufficient to keep up with the vapor sinks. By following the above procedures, consistent results were obtained for AgI, kaolin, soil particles, and pollution aerosols in both laboratory and field applications in the -5 to -20°C range. (Sims-ISWS) W75-10052

#### THE POSITION STABILITY OF LARGE WATER DROPS SUSPENDED IN A VERTICAL WIND TUNNEL,

Auckland Univ. (New Zealand). Dept. of Physics.

M. C. Woodward, and C. D. Stow.

Journal of Applied Meteorology, Vol 14, No 4, p 571-577, June 1975. 10 fig, 1 tab, 9 ref.

Descriptors: \*Drops(Fluids), \*Stability, \*Turbulence, Flow, Turbulent flow, Suspension, Cloud physics, Laboratory tests, Laboratory equipment, Velocity, Shear, Meteorology.

Identifiers: \*Wind tunnels, Vertical wind tunnels.

The behavior of water drops of diameter in excess of 3 mm suspended in a vertical wind tunnel was described and the vertical-position stability quantitatively and qualitatively assessed. The contribution to vertical instability caused by measured turbulence was calculated but does not fully account for the degree of instability observed. It was suggested that an inherent instability arises from the airflow constraints required to maintain a drop in the working section of the tunnel. When a drop is retained by such constraints, the artificial conditions under which experiments are performed will limit the applicability of results obtained in the wind tunnel to the atmosphere. (Sims-ISWS) W75-10053

#### EQUIVALENT BLACKBODY TEMPERATURE OF THE TOP OF A SEVERE STORM,

Lyndon B. Johnson Space Center, National Aeronautics and Space Administration, Houston, Tex.

D. E. Pitts, W. K. Reeser, and M. A. Mendlowitz. Journal of Applied Meteorology, Vol 14, No 4, p 609-618, June 1975. 13 fig, 36 ref.

Descriptors: \*Clouds, \*Storms, \*Temperature, \*Remote sensing, Aerial photography, Radar, Thunderstorms, Radiation, Instrumentation, Analysis, Spectrometers, Infrared radiation, Meteorology, On-site data collections.

Identifiers: \*Radiometers.

An experiment was undertaken to measure the equivalent blackbody temperature of cloud tops of a severe storm. This was done to evaluate the common meteorological practice of determining cloud top altitude by equating the equivalent blackbody temperature to the corresponding temperature from a nearby radiosonde and to provide data for determining radiative heat transfer mechanisms in the cloud top. Near Graham, Texas, infrared spectra in the spectral range of 6.7 to 13.3 microns were collected 29 April 1970 from the top of a severe storm 12.4 to 14.0 km in altitude. Absolute altitude of the cloud tops was determined by AS-11 Al plotter analysis of stereoscopic pairs of photographs taken with an RC-8 camera. The equivalent blackbody temperature of the cloud top was determined by fitting the Planck radiation function to the data. The radiometrically derived temperature of the cloud top is 4 to +7 K warmer than the environmental temperature as determined from radiosonde data for any given storm top altitude. Two temperature anomalies approximately 500 m in diameter were found near opposite sides of a 1 km wide and 13.8 km high cloud tower. Each of these anomalies is 6 to 9 K warmer than the surrounding cloud equivalent blackbody temperature of 209 K. It was proposed that the anomalies observed are dry air subsidence on the edge of an updraft that perturbs cloud particle spectra. The infrared extinction coefficient due to the cloud is decreased and thermal radiation from the interior of the warmer cloud is allowed to escape. (Sims-ISWS) W75-10054

#### EVALUATION OF AN ERTS-1 DATA COLLECTION PLATFORM INSTALLED IN THE ALPINE TUNDRA, COLORADO,

Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

For primary bibliographic entry see Field 7B.

W75-10055

## WATER CYCLE—Field 2

### Evaporation and Transpiration—Group 2D

**THE EFFECT OF REPEATED ACTIVATION ON DEPOSITIONAL ICE NUCLEI,**  
Chicago Univ., Ill. Cloud Physics Lab.  
P. Spyres-Duran.  
Journal of Applied Meteorology, Vol 14, No 4, p  
628-629, June 1975. 1 tab, 2 ref. NSF Grant GI  
33373.

Descriptors: \*Nucleation, \*Laboratory tests, Crystals, Crystal growth, Ice, Filters, Meteorology, Cloud physics.  
Identifiers: \*Ice nuclei, Activation, Membrane filters.

Ice nuclei collected on Millipore filters were processed at -16.6°C water saturation and resulting crystals were allowed to sublime. The filters were then reprocessed. Eighty-three percent of the original sites reactivated, 17% did not, but 12% of the new crystals were located on new sites. This suggests that if an ice crystal should evaporate in natural clouds, the remaining nucleus could be reactivated, and serve again to grow a new ice crystal by vapor deposition. (Sims-ISWS)  
W75-10056

**SUMMARY OF OBSERVATIONS INDICATING DYNAMIC EFFECT ON SALT SEEDING IN WARM CUMULUS CLOUDS,**  
Institute of Tropical Meteorology, Poona (India).  
For primary bibliographic entry see Field 3E.  
W75-10057

### 2C. Snow, Ice, and Frost

**SNOWFALL ENHANCEMENT,**  
National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.  
H. Weickmann.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 127-141, 1974. 16 fig, 2 tab, 27 ref.

Descriptors: \*Weather modification, \*Snowfall, \*Artificial precipitation, \*Cloud seeding, Cloud physics, Atmospheric physics, Precipitation(Aerospheric), Nucleation, Condensation, Crystals, Carbon dioxide, Meteorology.  
Identifiers: \*Snow enhancement, Seeding patterns, Snow crystals.

The insight into the interrelationship between several parameters--some of them are microscale, some are mesoscale--in nature has brought the understanding of the snow process into sharper focus. The most important mesoscale parameter is the rate of condensation which determines the amount of moisture released for precipitation. The most important microphysical parameter is the concentration of snow crystals furnished by nature. The concentration of snow crystals was shown to depend on two factors: (1) the concentration of freezing nuclei and (2) the rate of upward flux of freezing nuclei. Precipitable water in a cloud appears in two forms: (1) as liquid water stored in the cloud and (2) as water released by the rate of updraft in the condensation process, that is, by the rate of condensation. Snowfall enhancement opportunities may present themselves through the microscale mechanism of snow formation as well as through the mesoscale flux parameters of cloud systems. Convective stratocumulus systems, upslope stratocumulus systems, and cyclonic shallow cloud systems were shown to offer potential for cloud seeding. Techniques of seeding for snow enhancement were discussed, and the merits of various seeding patterns were described. Some results of snow enhancement projects were reported. (See also W75-09944) (Sims-ISWS)  
W75-09959

**SEEDING REQUIREMENTS FOR RAPID GLACIATION OR STIMULATION OF A MIXED PHASE CLOUD,**  
State Univ. of New York, Albany. Atmospheric Sciences Research Center.  
For primary bibliographic entry see Field 3B.  
W75-09963

**THE PYRAMID PILOT CLOUD-SEEDING PROJECT,**  
Nevada Univ., Reno. Desert Research Inst.  
For primary bibliographic entry see Field 3B.  
W75-09964

**AN ICE NUCLEI CONCENTRATION BENCHMARK NETWORK,**  
National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.  
For primary bibliographic entry see Field 7A.  
W75-09999

**ICE NUCLEI GENERATOR TECHNOLOGY,**  
Denver Research Inst., Colo.  
For primary bibliographic entry see Field 3B.  
W75-10001

**AN EXPERIMENTAL STUDY OF THE DETECTION OF ICE NUCLEI ON MEMBRANE FILTERS AND OTHER SUBSTRATA,**  
National Center for Atmospheric Research, Boulder, Colo.  
For primary bibliographic entry see Field 2B.  
W75-10052

**THE EFFECT OF REPEATED ACTIVATION ON DEPOSITIONAL ICE NUCLEI,**  
Chicago Univ., Ill. Cloud Physics Lab.  
For primary bibliographic entry see Field 2B.  
W75-10056

**ENGINEERING UTILITY AND SEWAGE LINES IN PERMAFROST SOIL,**  
For primary bibliographic entry see Field 5D.  
W75-10192

### 2D. Evaporation and Transpiration

**EFFECTS OF IRRIGATION AND ROW SPACING ON EVAPOTRANSPIRATION AND MICROCLIMATE OF A SORGHUM FIELD,**  
Kansas State Univ., Manhattan Evapotranspiration Lab.  
E. T. Kanemasu, and W. L. Powers.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 557, \$4.25 in paper copy, \$2.25 in microfiche. Kansas Water Resources Research Institute, Manhattan, Contribution No. 166, May 1975. 54 p, 7 tab, 16 fig, 4 ref. OWRT A-056-KAN(1). 14-31-0001-3816.

Descriptors: \*Evaporation, \*Transpiration, \*Irrigation effects, \*Evapotranspiration, Microclimatology, \*Sorghum, \*Kansas, \*Model studies, Energy budget, Advection, Carbon dioxide, Wheat, Soybeans, Crop production, Furrow irrigation, Cover crops.  
Identifiers: \*Net carbon dioxide exchange, Manhattan(Kan).

An evapotranspiration model was tested over the 1973 growing season at Manhattan, Kansas. The model predicted daily evapotranspiration rates that were within 1 to 2 mm of lysimetric estimates. Evaporation accounted for 22% of the seasonal evapotranspiration. Energy balance over wide and narrow row sorghum indicated within row advection early in the growing season and large scale advection at near maturity. Advection was greater in the wide-row sorghum. Seasonal evapotranspiration rates were 54 and 52 cm for the narrow and wide row sorghum, respectively. Hourly net carbon dioxide exchange rates were determined for wheat, sorghum and soybean. Sorghum canopy had nearly twice the net carbon dioxide exchange of the wheat and soybean canopies.  
W75-09853

tion rates were 54 and 52 cm for the narrow and wide row sorghum, respectively. Hourly net carbon dioxide exchange rates were determined for wheat, sorghum and soybean. Sorghum canopy had nearly twice the net carbon dioxide exchange of the wheat and soybean canopies.  
W75-09853

**PREDICTING EVAPOTRANSPIRATION FROM AGRICULTURAL WATERSHEDS UNDER DRY CONDITIONS,**  
Kansas State Univ., Manhattan. Dept. of Civil Engineering.

J. J. Zovne, and A. Nawaz.  
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 562, \$4.25 in paper copy, \$2.25 in microfiche. Kansas Water Resources Research Institute, Manhattan, Contribution No 164, May 1975. 66 p, 11 fig, 7 tab, 28 ref, 2 append. OWRT A-050-KAN(1). 14-31-0001-3516.

Descriptors: \*Evapotranspiration, \*Streamflow, \*Agricultural watersheds, Runoff, Evaporation, Transpiration, Soil moisture, Hydrographs, \*Kansas, \*Simulation analysis, Rainfall, \*Model studies, \*Forecasting, Crop production, Distribution, Data collections, Dry seasons.  
Identifiers: \*Watershed models, Penman Combination equation, \*Black Vermillion Watershed(Kan).

A new evapotranspiration (ET) function for the Kansas Water Budget model is developed and tested on the Black Vermillion watershed in Northeastern Kansas. The purpose of the new ET function is to improve the response of Kansas model to daily climatic changes and to the distribution and stage of growth of crops on an agricultural watershed. The new function uses the Penman Combination equation modified by three coefficients which account for, (1) the soil moisture availability, (2) the increased soil surface evaporation following rainfall, and (3) for the crop transpiration efficiency which varies with the crop and the stage of growth. The new function was programmed into the present Kansas model and both the present and the revised models were applied to the Black Vermillion for comparison purposes. Improvements were noted in daily and weekly responses of the revised model. In particular, the overall correlations of calculated to observed daily streamflows for the 1954 through 1967 study period were improved from 0.58 to 0.78 with the revised model. The significant improvement in streamflow simulation accuracy requires a modest increase in required input data and computer time. If planning efforts revolve around optimizing yields from agricultural watersheds, the extra costs would be warranted.  
W75-09860

**AN INVESTIGATION OF THE PREDICTIVE ABILITY OF SEVERAL EVAPORATION EQUATIONS,**  
California Univ., Davis. Dept. of Chemical Engineering.

F. W. Pierson, and A. P. Jackman.  
Journal of Applied Meteorology, Vol 14, No 4, p  
477-487, June 1975. 5 fig, 4 tab, 16 ref, 1 append.

Descriptors: \*Evaporation, \*Equations, \*Forecasting, Atmosphere, Meteorological data, Drag, Velocity, Eddies, Momentum transfer, Friction, Momentum equation, Temperature, Water vapor, Wind velocity, Humidity, Profiles, Diffusivity.  
Identifiers: \*Flux-gradient equations, Log-law equations.

A number of integrated flux-gradient type evaporation equations were tested by using accurate evaporation and meteorological data. The estimated evaporation was compared with the measured evaporation. Most of the equations originally were derived by assuming that the ratio

## Field 2—WATER CYCLE

### Group 2D—Evaporation and Transpiration

of the eddy diffusivity of momentum to the eddy diffusivity of water vapor is constant. Since recent developments have shown that this ratio is a function of atmospheric stability, these equations were revised to admit variability of the ratio and were tested in the revised form. The momentum flux appeared in all evaporation equations tested. Results showed that the accuracy of the evaporation estimation was critically dependent on the accuracy of the momentum flux estimation by the velocity profile equation from which the evaporation equation was derived. In general, profile equations that produce momentum fluxes in good agreement with measured values produce accurate evaporation equations. Of the equations tested, an evaporation equation based on the Brooks wind velocity profile equation and a modified form of the Deacon and Swinbank evaporation equation were found to be the most accurate. A semi-empirical equation proposed by Pruitt was also found to give good results, but may require further calibration. (Roberts-ISWS)  
W75-10051

**EVAPORATION DATA IN TEXAS—COMPIRATION REPORT, JANUARY 1907-DECEMBER 1970.**  
Texas Water Development Board, Austin.  
For primary bibliographic entry see Field 7C.  
W75-10154

**EVALUATION OF RESERVOIR SITES IN NORTH CAROLINA—REGIONAL RELATIONS FOR ESTIMATING THE RESERVOIR CAPACITY NEEDED FOR A DEPENDABLE WATER SUPPLY,**  
Geological Survey, Raleigh, N.C.  
For primary bibliographic entry see Field 4A.  
W75-10159

### 2E. Streamflow and Runoff

**FRICITION COEFFICIENTS FOR LAMINAR SHEET FLOW OVER ROUGH SURFACES,**  
University of the West Indies, Kingston (Jamaica).  
For primary bibliographic entry see Field 8B.  
W75-10062

**SURFACE WATER DATA, REFERENCE INDEX, CANADA 1974.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10064

**HISTORICAL STREAMFLOW SUMMARY, BRITISH COLUMBIA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10065

**HISTORICAL STREAMFLOW SUMMARY, ONTARIO, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10066

**HISTORICAL STREAMFLOW SUMMARY, ALBERTA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10067

**HISTORICAL STREAMFLOW SUMMARY, YUKON AND NORTHWEST TERRITORIES, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10068

**HISTORICAL STREAMFLOW SUMMARY, MANITOBA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10069

**HISTORICAL STREAMFLOW SUMMARY, SASKATCHEWAN, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10070

**HISTORICAL STREAMFLOW SUMMARY, ATLANTIC PROVINCES, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10071

**THE DISCHARGE OF SOUTH CAROLINA STREAMS AS IT RELATES TO LINK MAGNITUDE,**  
South Carolina Univ., Columbia. Dept. of Geology.

D. E. Reynolds.  
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 885, \$4.75 in paper copy, \$2.25 in microfiche. M.S. Thesis, 1972. 59 p., 9 fig., 6 tab., 43 ref., 3 append. OWRT A-026-SC(6).

Descriptors: \*Streamflow forecasting, \*South Carolina, \*Discharge(Water), \*Regression analysis, \*Flow characteristics, Coastal plains.  
Identifiers: Link magnitude, Piedmont, First order streams.

Linear regression analyses have been used to evaluate link magnitude as a predictor of stream flow. These analyses were also used to investigate the effects of climate and geology on stream flow characteristics and to show differences in flow characteristics of Piedmont and Coastal Plain streams. An evaluation of the contribution of first order streams to total discharge was made at two different map scales.  
W75-10134

**DISCHARGE MEASUREMENTS AT LOW-FLOW PARTIAL-RECORD STATIONS IN IOWA.**  
Geological Survey, Iowa City, Iowa.  
For primary bibliographic entry see Field 7C.  
W75-10144

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1973,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10148

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1973,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10151

**A TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN MAINE,**  
Geological Survey, Augusta, Maine.  
R. A. Morrill.  
Open-file report 75-292, 1975. 44 p., 10 fig., 7 tab., 12 ref.

Descriptors: \*Flood forecasting, \*Flood frequency, \*Flood discharge, \*Maine, Analytical techniques, Flood peak, Water yield, Discharge(Water), Streamflow, Curves, Gaging stations, Regression analysis, Correlation analysis, Hydrologic data.

Identifiers: Nomographs.

Magnitude and frequency of annual flood discharges has been defined by a log-Pearson Type III frequency analysis for 60 sites on Maine streams where flood records cover at least 10 years. A technique also is presented for estimating flood-frequency relations, up to the 100-year recurrence interval, for streams in Maine where floodflow is virtually natural. The estimating technique requires determination of the size of drainage area, main channel slope, and percentage of storage (lakes and ponds) in the basin. An example is given to demonstrate a step-by-step procedure for applying the technique. (Woodard-USGS)  
W75-10155

**EVALUATION OF RESERVOIR SITES IN NORTH CAROLINA—REGIONAL RELATIONS FOR ESTIMATING THE RESERVOIR CAPACITY NEEDED FOR A DEPENDABLE WATER SUPPLY,**  
Geological Survey, Raleigh, N.C.  
For primary bibliographic entry see Field 4A.  
W75-10159

**ESTIMATING MEAN STREAMFLOW IN THE DUCESNE RIVER BASIN, UTAH,**  
Geological Survey, Salt Lake City, Utah.  
R. W. Cruff.  
Utah Department of Natural Resources, Salt Lake City, Technical Publication No 48, 1975. 18 p., 3 fig., 1 plate, 4 tab., 1 ref.

Descriptors: \*Streamflow forecasting, \*Average flow, \*Utah, Methodology, Discharge measurement, Monthly, Hydrographs, Correlation analysis, Analytical techniques, Estimating.  
Identifiers: \*Duchesne River basin(Utah), Monthly streamflow measurements.

Monthly, annual, and long-term mean streamflow were estimated for streams in the Duchesne River basin, Utah, by use of monthly measurements. Monthly measurements were made at 44 sites in the basin during the 1971 and 1972 water years. For those sites at which measurements could not be made under certain conditions, monthly discharge was determined by the use of daily hydrographs for nearby gaging-station sites. A comparison of long-term mean annual discharge determined by the monthly measurement method versus that determined from gaging-station records was as follows: Good at three sites (8 percent or less), fair-to-poor at one site (39 percent), and poor at one site (87 percent). At the three sites that showed good comparisons, there was flow at every monthly visit and the sites were above most diversions. The site where comparison was fair-to-poor is affected by upstream diversion; at the site where the comparison was poor, the stream was dry at the time of many of the monthly visits. (Woodard-USGS)  
W75-10166

**COLORADO RIVER-FLOW MANAGEMENT,**  
Bureau of Reclamation, Denver Colo.  
For primary bibliographic entry see Field 4A.  
W75-10208

**TRANSIENT CONTROL IN LOWER SACRAMENTO RIVER,**  
Bureau of Reclamation, Sacramento, Calif. Applications Branch.  
For primary bibliographic entry see Field 4A.  
W75-10219

## WATER CYCLE—Field 2

### Groundwater—Group 2F

#### 2F. Groundwater

##### STATUS OF LAND SUBSIDENCE DUE TO GROUND-WATER WITHDRAWAL ALONG THE MISSISSIPPI GULF COAST,

Mississippi State Univ., Mississippi State. Dept. of Geology and Geography.

D. M. Keady, T. W. Lins, and E. E. Russell.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 558, \$3.75 in paper copy, \$2.25 in microfiche. Mississippi Water Resources Research Institute, Mississippi State, Completion Report, July 1975. 25 p, 5 fig, 16 ref. OWRT A-085-MISS(1).

Descriptors: \*Land subsidence, Mississippi, Gulf of Mexico, Subsidence, \*Withdrawal, \*Groundwater, \*Compaction, Consolidation, Stress, Aquitards, Water level fluctuations, Aquifers.

Identifiers: \*Mississippi Gulf Coast, Preconsolidation.

Land subsidence due to ground-water withdrawal along the Mississippi Gulf Coast has not occurred to the measurable extent that it has in New Orleans, La., Baton Rouge, La., and the Houston, Texas, area. A potential for subsidence exists, and future large-scale ground-water developments make the possibility of subsidence important. The quantity of water produced, as well as water-level declines, should be considered in estimating potential for subsidence. Using the average specific-unit compaction value measured in the Houston, Texas area, subsidence due to ground-water withdrawal along the Mississippi Gulf Coast is estimated to be a few inches at most. Decreases in elevation of bench marks of about four to five inches are common along the coast, but this subsidence is attributed to tectonic activity and other causes. An unknown factor is 'preconsolidation' of the aquitards by loading and unloading, particularly as a result of the fluctuations of sea level during the Pleistocene Epoch. Stresses on the aquitards produced by ground-water withdrawal would have to exceed prior loading stress before significant amounts of compaction and land subsidence could occur.

W75-09856

##### AQUIFER PARAMETERS BY A CHEMICAL TRACER TECHNIQUE: NON LINEAR MIXING IN THE ROSWELL CONFINED AQUIFER,

New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.

V. LeFebre.

Available from the National Technical Information Service, as PB-243 563, \$3.75 in paper copy, \$2.25 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Report No. 056, June 1975, 33 p, 6 fig, 3 tab, 3 ref. B-038-NMEX OWRT (2).

Descriptors: \*Aquifer characteristics, Aquifer systems, \*Groundwater movement, Aquifers, Groundwater, Groundwater basins, Groundwater recharge, \*Calcite, Gypsum, Carbon dioxide, Sodium chloride, \*Mixing, Saturation, \*New Mexico, Chemical analysis, \*Tracers, Soil tests.

Identifiers: \*Roswell(NMEx), Groundwater basin, Confined limestone aquifer, Aquifer mixing, Chemical tracers.

Soil column tests and chemical analyses of water samples from the Roswell ground water basin indicate that water is saturated with calcite before entering the aquifer. It is postulated that calcite precipitation and dissolution occurring within the aquifer result from nonlinear mixing effects. Four such effects are developed and applied to the Roswell ground water basin. Mixing caused by leakage from the unconfined to the confined aquifer is clogging the confined aquifer with a calcite precipitate. (Hain-New Mexico State).

W75-09893

FINITE ELEMENT MODELING OF FLOW THROUGH POROUS MEDIA,  
State Univ., of New York, Buffalo. Faculty of Engineering and Applied Sciences.  
For primary bibliographic entry see Field 5B.  
W75-09900

GROUNDWATER POLLUTION: PROBLEMS AND SOLUTIONS.  
For primary bibliographic entry see Field 5B.  
W75-10058

EVALUATION OF GROUND WATER RESOURCES: LIVERMORE AND SUNOL VALLEYS,  
California State Dept. of Water Resources, Sacramento.  
R. S. Ford, and E. E. Hills.  
Bulletin No. 118-2, June 1974. 153 p, 32 fig, 22 tab, 2 append.

Descriptors: \*Groundwater resources, \*Hydrogeology, \*California, \*Water supply, \*Water quality, \*Geologic formations, Geologic units, Water levels, Land use, Groundwater basins, Aquifers, Subsurface waters, Water resources development, Groundwater movement, Natural recharge, Artificial recharge, Computer models, Transmissivity, Mathematical models, Streamflow, Precipitation(Atmospheric), Storage, Pumping.  
Identifiers: \*Livermore Valley(Calif), \*Sunol Valley(Calif).

Livermore and Sunol Valleys are part of the rapidly urbanizing metropolitan region surrounding San Francisco Bay. These two valleys contain three basic resources: land, gravel, and water. In the late 1940s and during the 1950s, water demand exceeded supply and groundwater levels declined. This trend has been stopped by the availability of a new water supply to the area from the Del Valle Reservoir. The present studies of the area will develop a better understanding of the groundwater resources leading to development and testing of alternative plans for conjunctive use of surface, ground, and waste waters. The geology and hydrology of the area were reported in sufficient detail to permit planning for use of the groundwater. (Sanderson-ISWS)  
W75-10063

A STUDY OF BEACH GROUND-WATER HYDROLOGY AND CHEMISTRY,  
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

T. F. Dominick, B. Wilkins, H. H. Roberts, and C. L. Ho.  
Available from the National Technical Information Service, Springfield, Va. 22161, as AD-773 552, \$5.25 in paper copy, \$2.25 in microfiche. Technical Report No 152, November 1973. 108 p, 40 fig, 8 tab, 4 append, 25 ref. NR 388 002, ONR N00014-69-A-0211-0003.

Descriptors: \*Water table, \*Beaches, \*Fluctuations, \*Hydrology, \*Mathematical models, Groundwater, Tidal effects, Intertidal areas, Sea water, Tropical regions, Sand aquifers, Chemical properties, Computer programs.

Identifiers: Grand Cayman Island.

A simplified mathematical model for beach groundwater fluctuations driven by tidal oscillations was developed and tested. The interstitial beach groundwater chemistry across a carbonate beach profile over several tidal cycles is described. The model was developed from nonlinear partial differential equations governing transient, one-dimensional movement of groundwater through porous media. A finite-difference algorithm for a digital computer was developed to solve the equations. Beach homogeneity and nonlinear boundary conditions imposed by tidal fluctuations were assumed. Field measurements of water table fluctua-

tions in Galleon Beach, Grand Cayman Island show that the mathematical model simulates this system within the limits of accuracy of experimental measurements. A method for in situ determination of the permeability-porosity ratio is proposed and demonstrated. Results from the study of the chemical environment showed that the carbonate beach may be divided into two zones: a freshwater zone containing high dissolved carbonates but very low salinity and a seawater-dominated intertidal zone containing salinity close to that of seawater and about half as much dissolved carbonates as the freshwater zone. The calculated values showed that the local surface seawater was constantly supersaturated with calcite, whereas the interstitial waters, especially in the intertidal zone, were considerably undersaturated. (Jones-Wisconsin)  
W75-10077

GROUND WATER,  
Geological Survey, Denver, Colo.

M. S. Bedinger.  
Water Spectrum, Vol 6, No 1, p 19-26, Spring 1975. 5 fig, 5 photos.

Descriptors: \*Groundwater resources, \*Water resources development, \*United States, Groundwater availability, Water management(Applied), Groundwater potential, Groundwater basins, Water yield, Water quality, Aquifer characteristics, Hydrogeology, Hydrology, Planning, Groundwater movement, Hydrologic cycle, Water balance, Thermal stress, Environmental effects, Water utilization.

This article describes the role of groundwater as an integral part of the overall water resources of the Nation, the relations between environmental stress and groundwater response, and methods of scientific groundwater management, and it illustrates the relation between groundwater and environmental stress by a few case histories. About 180 billion acre-feet of potable water lies within a few thousand feet of the American land surface. At the present time only about 20 percent of our withdrawals for uses other than hydropower generation comes from groundwater. The proper application of scientific principles in developing and managing our groundwater resources is essential. Stresses on an aquifer, both natural and man induced, can be classified as hydraulic, thermal, and chemical. The response to any given stress will be in accordance with the laws of conservation of energy and mass. The equation of continuity, inflow minus outflow = change in storage, is a means of stating the mass balance equation when considering the hydraulic stress and response in the system. Similar equations could be expressed regarding the thermal and chemical balance in the aquifer. (Woodard-USGS)  
W75-10143

CARBON-14 AGES OF WATER FROM THE AR-KANSAS HOT SPRINGS,  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 2K.  
W75-10145

GROUND-WATER DISCHARGE FROM THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1974,  
Geological Survey, San Antonio, Tex.

R. A. Rappmund.  
Edwards Underground Water District, San Antonio, Texas, Bulletin 34, July 1975. 8 p, 1 tab, 14 ref.

Descriptors: \*Groundwater resources, \*Pumping, \*Water yield, \*Water utilization, \*Texas, Aquifer characteristics, Water wells, Withdrawal, Hydrologic data.  
Identifiers: \*San Antonio area(Tex), Edwards and associated limestones, Groundwater discharge.

## Field 2—WATER CYCLE

### Group 2F—Groundwater

The estimated total well and spring discharge from the Edwards and associated limestones in the San Antonio, Texas, area during 1974 was 847,500 acre-feet, which is the record high for the period 1934-74. The total discharge from wells and springs for 1974 was about 1% more than in 1973 and 53% more than the average for 1934-73. About 43% of the total discharge came from wells, and approximately two-thirds of the well discharge was from wells in Bexar County. Well discharge in 1974 was 17% more than in 1973, while springflow decreased by about 8%. (Woodard-USGS) W75-10146

**GEOOTHERMAL INVESTIGATIONS IN IDAHO: PART 3, AN EVALUATION OF THERMAL WATER IN THE WEISER AREA, IDAHO,** Geological Survey, Boise, Idaho. For primary bibliographic entry see Field 4B. W75-10147

**WATER DEVELOPMENT FOR IRRIGATION IN NORTHWESTERN KANSAS,** Geological Survey, Lawrence, Kans. For primary bibliographic entry see Field 4B. W75-10152

**GROUND-WATER HYDROLOGY OF GARNER VALLEY, SAN JACINTO MOUNTAINS, CALIFORNIA--A MATHEMATICAL ANALYSIS OF RECHARGE AND DISCHARGE,** Geological Survey, Menlo Park, Calif. T. J. Durbin. Open-file report 75-305, June 1975. 40 p, 15 fig, 5 tab, 21 ref.

Descriptors: \*Hydrogeology, \*Discharge(Water), \*Groundwater recharge, \*Aquifer characteristics, Finite element analysis, \*California, Water yield, Pumping, Hydrology, Water transfer, Groundwater resources, Mathematical studies, Phreatophytes, Reservoirs. Identifiers: \*Garner Valley(Calif).

Garner Valley is an intermontane alluvial basin in the San Jacinto Mountains, California. An alluvial aquifer with a surface area of 21 square miles underlies the valley floor. A finite-element mathematical representation of the aquifer was used to compute average annual recharge and discharge. The aquifer is in an equilibrium state and recharge from precipitation equals groundwater discharge to phreatophytes and to Lake Hemet, a reservoir in the northern part of the valley. The average annual recharge is about 2,200 acre-feet. The average annual discharge to the phreatophytes is about 1,150 acre-feet, the average annual discharge to Lake Hemet is about 1,000 acre-feet, and the average annual discharge via other minor avenues is about 50 acre-feet. Water developers in an adjacent drainage basin are considering the annual export of 400 to 900 acre-feet of groundwater from Garner Valley, which would result in an equal reduction of the natural groundwater discharge in the valley. (Woodard-USGS) W75-10158

**THE CAPE COD WATER PROGRAM, A CURRENT ANALYSIS,** Massachusetts State Geology Office, Boston. For primary bibliographic entry see Field 4B. W75-10283

### 2G. Water In Soils

**RESEARCH STATUS ON EFFECTS OF LAND APPLICATION OF ANIMAL WASTES,** Kansas State Univ., Manhattan. For primary bibliographic entry see Field 5B. W75-10022

**A MODEL OF ONE-DIMENSIONAL PERCOLATION TO A WATER TABLE USING A COMPUTER SIMULATION LANGUAGE,** Clemson Univ., S.C. Dept. of Agricultural Engineering. T. G. King.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 889, \$5.25 in paper copy, \$2.25 in microfiche. M.S. Thesis, December 1972. 98 p, 4 tab, 20 fig, 71 ref, 3 append. OWRT A-023-SC(4).

Descriptors: Water table, \*Percolation, \*Computer models, Evapotranspiration, Root zone, Seepage, \*Soil moisture, Model studies, Moisture content, Programming languages.

A computer model was developed that simulates the quantity and movement of moisture involved in the deep seepage process. The deep seepage process extends from the bottom of the root zone, in the unsaturated flow region, down to the phreatic surface. The model is written in the modeling language CSMP. In one submodel, termed the Root Zone Model, a water balance is used, with measured precipitation and temperature as inputs, to evaluate the processes of runoff, evapotranspiration, root zone storage, and deep seepage. The deep seepage that percolates below the root zone moves down towards the water table. This downward motion is modeled in a submodel called the Deep Seepage Model. The input to this model is the pattern of deep seepage derived from the Root Zone Model. A finite difference form of Darcy's equation is used to compute moisture movement through the profile, which is considered to exist as a series of discrete layers. The soil properties used for each layer are considered to be the average for the entire layer and are applied at the center of the layer. A method to deal with soil inhomogeneity was formulated based on the moisture retention of the soil. The performance of the model was appraised by comparison of the results to field data and published analyses of these data. Figures were presented comparing evapotranspiration, deep seepage and root zone storage with these data. Profiles through the deep seepage region were used to evaluate the redistribution model. Predicted movement of the water table was compared to recorded values. W75-10138

**PROBLEMS WITH EFFLUENT SEEPAGE FIELDS,** Connecticut Univ., Storrs. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W75-10274

### 2H. Lakes

**THE EFFECTS OF ARTIFICIAL DESTRATIFICATION ON THE WATER QUALITY AND MICROBIAL POPULATIONS OF HYRUM RESERVOIR,** Utah Center for Water Resources Research, Logan. For primary bibliographic entry see Field 5C. W75-09897

**A MODEL FOR PREDICTING THE EFFECTS OF SEWAGE EFFLUENT ON WETLAND ECOSYSTEMS,** Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 5B. W75-09915

**ECONOMIC ASPECTS OF PRECIPITATION AUGMENTATION OVER THE GREAT LAKES,** Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 6B. W75-09992

**THE GEOCHEMICAL AND BIOSTRATIGRAPHIC RECORD OF NATURAL AND POLLUTIONAL EUTROPHICATION OF MINNESOTA LAKES,** Minnesota Univ., Minneapolis. Dept. of Botany. For primary bibliographic entry see Field 5C. W75-10010

**CHLORINATED HYDROCARBONS IN THE LAKE ONTARIO ECOSYSTEM, (IFYGL),** Wisconsin Univ., Madison. Water Chemistry Program. For primary bibliographic entry see Field 5A. W75-10018

**CHANGES IN THE SUBMERGED MACROPHYTE COMMUNITIES OF LAKE WABAMUM AS A RESULT OF THERMAL DISCHARGES,** Alberta Univ., Edmonton. Dept. of Botany. For primary bibliographic entry see Field 5C. W75-10074

**THE EUTROPHICATION OF LAKES IN THE OKANAGAN VALLEY, BRITISH COLUMBIA,** Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 5C. W75-10075

**FLUXES, RESIDENCE TIMES, AND SOURCES OF SOME ELEMENTS TO LAKE MICHIGAN,** Hope Coll., Holland, Mich. Dept. of Chemistry. For primary bibliographic entry see Field 5C. W75-10090

**AN ECOSYSTEM MODEL FOR THE PELAGIC ZONE OF LAKE WINGRA,** Wisconsin Univ., Madison. For primary bibliographic entry see Field 5C. W75-10092

**THE STRUCTURE AND PRODUCTION OF PHYTOPLANKTON IN MIKOŁAJSKIE LAKE,** Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology. For primary bibliographic entry see Field 5C. W75-10093

**EXPERIMENTALLY INCREASED FISH STOCK IN THE POND TYPE LAKE WARNIAK. I. PHYSICAL AND CHEMICAL CONDITIONS IN LAKE WATER,** Instytut Rybactwa Śródziemnego, Gazycko (Poland). Lake Field Station. For primary bibliographic entry see Field 5C. W75-10094

**PHOSPHORUS RUN-OFF FROM THE DRAINAGE BASIN TO MIKOŁAJSKIE LAKE,** Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology. For primary bibliographic entry see Field 5C. W75-10095

**ACTIVITIES, CHARACTERISTICS, AND OPINIONS OF LAKEFRONT RESIDENTS: KISSIMMEE RIVER BASIN, FLORIDA,** Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences. For primary bibliographic entry see Field 6B. W75-10129

**EFFECTS OF FIRE ON THE PLANTS AND ANIMALS OF A FLORIDA WETLAND,** California State Univ., Los Angeles. Dept. of Biology. For primary bibliographic entry see Field 6G. W75-10181

## WATER CYCLE—Field 2

### Chemical Processes—Group 2K

**EFFECT OF WIND WAVES AND WIND TIDES ON THE OPTIMUM CONTROL OF LARGE LAKES,**  
Arizona Univ., Tucson. Bureau of Business Research.  
For primary bibliographic entry see Field 4A.  
W75-10204

#### 2I. Water In Plants

**EFFECTS OF INTRODUCED BULLFROGS, RANA CATESBEIANA, ON THE NATIVE FROGS OF THE SAN JOAQUIN VALLEY, CALIFORNIA,**  
California Univ., Davis. Dept. of Animal Physiology.  
P. B. Moyle.

Copeia. Vol 1973, No 1, p 18-22, 1973.

Identifiers: \*Bullfrogs, \*California, Competition, \*Frog habitats, Predation, *Rana-aurora*, *Rana-boylii*, *Rana-catesbeiana*, San-Joaquin(Calif.).

*R. catesbeiana* was introduced into California, between 1914 and 1920 and has since spread throughout the state. In the San Joaquin Valley it has become the dominant frog on the valley floor and has spread into the Sierra Valley Nevada foothills. It is most abundant in the warm low elevation pools of the foothill streams, in areas heavily altered by man, although at least 2 populations are established above 1600 m elevation. Of the 2 frog species native to this region, *R. aurora* is either absent or very rare at the present time, while *R. boylii* is found mostly in small permanent foothill streams higher than 200 m elevation, in areas not occupied by *R. catesbeiana*. The disappearance of *R. aurora* from the region and the continuing reduction in range of *R. boylii* are attributed to habitat alteration coupled with predation and competition from *R. catesbeiana*.—Copyright 1973, Biological Abstracts, Inc.

W75-10114

#### 2J. Erosion and Sedimentation

**SILTATION RATES AND LIFE EXPECTANCIES OF SMALL HEADWATER RESERVOIRS IN MONTANA,**

Montana Univ., Missoula. School of Forestry.

P. S. Marsh, and R. Konizeski.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 560, \$4.25 in paper copy, \$2.25 in microfiche. Research Report Number 65, Montana University Joint Water Resources Research Center, Bozeman, March 1975. 71 p, 27 fig, 7 tab, 64 ref. OWRT B-031-MONT(1).

Identifiers: \*Montana, \*Siting, Headwaters, Silts, \*Reservoir silting, \*Reservoir sites, \*Sedimentation, \*Water storage, Water supply, Small watersheds, Alpine.

Identifiers: \*Headwater reservoirs, Reservoir life, Small reservoirs, \*Siltation rates, \*Alpine reservoirs.

The objective was to determine the sedimentation rates and life expectancies of small headwater reservoirs in Montana. Thirty-five reservoirs were chosen to sample in detail. Life expectancies are (1) generally 'infinite' (500 to several hundred thousand years) for alpine reservoirs, (2) generally a few tens to a few thousands of years for montane reservoirs, (3) several hundred years for subdued-montane reservoirs, (4) one hundred to 2,000 years, for piedmont-foothills reservoirs, and (5) a few tens to one thousand years for plains reservoirs. Siting of small headwater reservoir in an alpine area is more desirable than in the other 'type' watersheds studied. The reservoir basin ideally should lie in impermeable rocks (to avoid subterranean water loss) which will provide only a negligible amount of sediment when subjected to wave action of the future reservoir. The watershed

should be well-mantled with vegetation, particularly in areas immediately above the reservoir. Gentle topography is preferable to steep topography (erosion potential is lower); northeast aspect is preferable to southwest (for delay in snowmelt or chance of better quantities of vegetative cover); high elevations and/or being out of a rain shadow is preferable to low elevations or areas lying in rain shadows (to be in a zone of adequate precipitation for water to store in the reservoir and for plant growth).  
W75-09858

**ARTIFICIAL REEF,**  
For primary bibliographic entry see Field 8A.  
W75-09879

**THE GEOCHEMICAL AND BIOSTRATIGRAPHIC RECORD OF NATURAL AND POLLUTIONAL EUTROPHICATION OF MINNESOTA LAKES,**  
Minnesota Univ., Minneapolis. Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W75-10010

**RESEARCH NEEDS AS RELATED TO THE DEVELOPMENT OF SEDIMENT STANDARDS IN RIVERS,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W75-10013

**EFFECTS OF SEDIMENT CONTROL ON SEDIMENT TRANSPORT IN THE NORTHWEST BRANCH ANACOSTIA RIVER BASIN, MONTGOMERY COUNTY, MARYLAND,**  
Geological Survey, College Park, Md.  
T. H. Yorke.

Available from Sup Doc, Wash., D.C. 20402, \$3.15 single journal copy; \$18.90 yearly subscription rate. Journal of Research of the U.S. Geological Survey, Vol 3, No 4, p 487-494, July-August 1975. 4 fig, 3 tab, 11 ref.

Identifiers: \*Sediment transport, \*Sediment control, \*Urbanization, \*Maryland, Data collections, Projects, Construction, Engineering structures, Sediment yield, Correlation analysis, Land use, Rivers.  
Identifiers: \*Montgomery County(Md.), \*Anacostia River basin(Md.).

Streamflow and sediment were monitored in an urbanizing drainage basin in southeastern Montgomery County, Md., from 1962 to 1972. During this period, urban construction areas averaged about 3 percent of the 21.1 sq mi basin. Urban land increased from 3.5 percent in 1959 to 20 percent in 1971. Virtually all the suspended sediment was transported during storms; three-fourths of it, during large storms. High sediment yields were observed in February, March, June, and August; and low yields generally from September through January. The decrease in sediment discharge in the latter half of the study period is attributed to a sediment-control program. Sediment discharge decreased 35 percent between 1967 and 1972, when effective control measures were installed on about half the construction sites. (Woodard-USGS)  
W75-10141

**ESTIMATE OF SEDIMENT DISCHARGES, SANTA ANA RIVER AT SANTA ANA AND SANTA MARIA RIVER AT GUADALUPE, CALIFORNIA,**  
Geological Survey, Menlo Park, Calif.

C. G. Kroll.  
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 412, \$3.25 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 40-74, February 1975. 18 p, 5 fig, 9 tab, 4 ref.

Descriptors: \*Sediment transport, \*Sediment yield, \*Sediment load, Rivers, California, Particle size, Bedload, Erosion, Beaches, Hydrologic data, Streamflow, Discharge(Water), Water temperature, Estimating.

Identifiers: \*Santa Ana River(Calif), \*Santa Maria River(Calif).

During the water years 1968-71 the mean daily suspended-sediment discharge of the Santa Ana River at Santa Ana, Calif., was 7,400 tons, and the mean daily coarse-sediment discharge was 3,400 tons. Extrapolated over the 31 water years (1941-71) of streamflow record, the mean daily values are 1,200 and 620 tons. In the Santa Maria River at Guadalupe, Calif., during the water years 1969-71, the mean daily suspended-sediment discharge was 8,700 tons and the mean daily coarse-sediment discharge was 5,500 tons. Extrapolated over the 31 water years (1941-71) of adjusted streamflow record, the mean daily values are 1,400 and 830 tons. The estimated long-term coarse-sediment discharge of the Santa Ana River is 620 tons per day or 190,000 cubic yards per year, and that of the Santa Maria River is 830 tons per day or 250,000 cubic yards per year. Only during floodflow is any significant quantity of sediment transported. In the Santa Maria River an estimated 99 percent of all coarse sediment was transported in 1 percent (113 days) of the 31-year period. (Woodard-USGS)  
W75-10162

**ARSENIC IN SEDIMENTS ON THE CONTINENTAL SHELF OF SOUTHEAST AUSTRALIA,**  
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).  
For primary bibliographic entry see Field 5B.  
W75-10177

**THE PUBLIC TRUST DOCTRINE AND THE CALIFORNIA COASTLINE,**  
San Diego State Univ., Calif.  
For primary bibliographic entry see Field 6E.  
W75-10305

#### 2K. Chemical Processes

**AQUIFER PARAMETERS BY A CHEMICAL TRACER TECHNIQUE: NON LINEAR MIXING IN THE ROSWELL CONFINED AQUIFER,**  
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.  
For primary bibliographic entry see Field 2F.  
W75-09893

**CARBON-14 AGES OF WATER FROM THE ARKANSAS HOT SPRINGS,**  
Geological Survey, Reston, Va.  
F. J. Pearson, Jr., M. S. Bedinger, and B. F. Jones.  
Reprinted from the Proceedings of the 8th International Conference on Radio Carbon Dating, Wellington, New Zealand, October 1972, p D19-D30. 2 fig, 3 tab, 9 ref.

Identifiers: \*Carbon radioisotopes, \*Radioactive dating, \*Hot springs, \*Arkansas, Hydrogeology, Water chemistry, Geochemistry, Carbonates, Silica, Groundwater movement.

The Arkansas Hot Springs are on the southern margin of the Ozark Mountains, Arkansas, and have surface temperatures from 55 to 62 deg C. The adjusted C-14 age of the Hot Springs waters is 4600 years, while ages of up to 9000 years are found in cold spring waters in the Bigfork Chert. Variations in permeability along, and length of flow paths may explain these age differences. Recharge is through the Bigfork Chert, which is principally chalcedony but also contains carbonate beds and lenses. The flow paths to the springs pass through the Arkansas Novaculite and they emerge from the Hot Springs Sandstone, both carbonate-

## Field 2—WATER CYCLE

### Group 2K—Chemical Processes

free formations. The silica content of all the Hot Spring waters is 41-42 mg/litre, which is equivalent to chalcedony saturation at 63 deg C. The Hot Springs themselves and cold spring and well waters from the Bigfork Chert are calcium bicarbonate waters. The Hot Springs contain less calcium and bicarbonate but could be derived from cold Bigfork waters by precipitation of  $\text{CaCO}_3$  accompanying heating. Delta C-13 values of carbonate species dissolved in all waters range from -13 to -15 parts per thousand; those of the Hot Springs corresponding to Bigfork water to the northeast of the Springs. No carbonate isotope exchange has occurred because of lack of carbonate minerals in the area of heating or relatively rapid flow through fractures in the area of heating. (Knapp-USGS)  
W75-10145

**GEOTHERMAL INVESTIGATIONS IN IDAHO: PART 3, AN EVALUATION OF THERMAL WATER IN THE WEISER AREA, IDAHO,**  
Geological Survey, Boise, Idaho.  
For primary bibliographic entry see Field 4B.  
W75-10147

**CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1970-SEPTEMBER 1971,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10153

**DISTRIBUTION OF NITROGEN AND PHOSPHOROUS IN THE CONSERVATION AREAS IN SOUTH FLORIDA FROM JULY 1972 TO JUNE 1973,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 5B.  
W75-10160

**HYDROLOGIC RECONNAISSANCE OF THE WAH WAH VALLEY DRAINAGE BASIN, MILLARD AND BEAVER COUNTIES, UTAH,**  
Geological Survey, Salt Lake City, Utah.  
For primary bibliographic entry see Field 4B.  
W75-10167

**THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN)—SOME QUESTIONS AND ANSWERS,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 5A.  
W75-10168

**REPORT OF COMMITTEE ON SURVEY OF GROUND WATER SUPPLIES IN NEW ENGLAND.**  
New England Water Works Association, Boston (Mass.).  
For primary bibliographic entry see Field 4B.  
W75-10182

**SOME APPLICATIONS OF THERMAL INFRA-RED LINESCAN IN WATER RESOURCES STUDIES,**  
Water Research Association, Marlow (England).  
For primary bibliographic entry see Field 5A.  
W75-10188

**GLC DETERMINATION OF PPB LEVELS OF CITRATE BY CONVERSION TO BROMOFORM,**  
Pfizer (Chas.) and Co., Inc., Groton, Conn.  
For primary bibliographic entry see Field 5A.  
W75-10191

### 2L. Estuaries

**STATUS OF LAND SUBSIDENCE DUE TO GROUND-WATER WITHDRAWAL ALONG THE MISSISSIPPI GULF COAST,**  
Mississippi State Univ., Mississippi State. Dept. of Geology and Geography.  
For primary bibliographic entry see Field 2F.  
W75-09856

**WAVE QUENCHING DEVICE,**  
Baker Hydro, Inc., Irvine, Calif. (assignee)  
For primary bibliographic entry see Field 4A.  
W75-09871

**ARTIFICIAL REEF,**  
For primary bibliographic entry see Field 8A.  
W75-09879

**THE FORGING OF THE UNION RECONSIDERED: A HISTORICAL REFUTATION OF STATE SOVEREIGNTY OVER SEABEDS,**  
Columbia Univ., N.Y. School of Law.  
For primary bibliographic entry see Field 6E.  
W75-09888

**FINITE ELEMENT MODELING OF FLOW THROUGH POROUS MEDIA,**  
State Univ., of New York, Buffalo. Faculty of Engineering and Applied Sciences.  
For primary bibliographic entry see Field 5B.  
W75-09900

**QUANTITATIVE ERROR ANALYSIS OF NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS,**  
Rutgers - the State Univ., New Brunswick, N.J. Dept. of Computer Science.  
For primary bibliographic entry see Field 6G.  
W75-10003

**BIOCHEMICAL AND NUTRITIONAL INTERACTIONS BETWEEN THE OYSTER (CRASSOSTERA VIRGINICA (GMELIN)) AND ITS ENVIRONMENT,**  
Maryland Univ., College Park. Dept. of Chemistry.  
For primary bibliographic entry see Field 5C.  
W75-10011

**RESIDENTIAL CANALS ALONG THE GULF COAST,**  
University of Southern Mississippi, Hattiesburg. Dept. of Geology.  
For primary bibliographic entry see Field 5B.  
W75-10016

**THE RESPONSE OF GYMNODINIUM BREVE TO MUNICIPAL WASTE MATERIALS,**  
University of South Florida, Tampa. Dept. of Chemistry.  
For primary bibliographic entry see Field 5C.  
W75-10033

**HYDRODYNAMIC LEVELLING OF AN OFF-SHORE TIDE GAUGE,**  
Institute of Oceanographic Sciences, Taunton (England).  
For primary bibliographic entry see Field 8B.  
W75-10060

**FAUNA AND FLORA IN HYDRAULIC CLAM DREDGE COLLECTIONS FROM FLORIDA WEST AND SOUTHEAST COASTS,**  
Florida Dept. of Natural Resources, St. Petersburg. Marine Research Lab.  
For primary bibliographic entry see Field 5C.  
W75-10079

**IDENTITY AND REGULATION OF NUTRIENTS LIMITING PHYTOPLANKTON IN THE SHALLOW ESTUARIES NEAR BEAUFORT, N.C.,**  
National Marine Fisheries Service, Beaufort, N.C. Atlantic Estuarine Fisheries Center.  
For primary bibliographic entry see Field 5C.  
W75-10084

**FLUVIAL-ESTUARINE WATER RESOURCE OPTIMIZATION: MICROECOSYSTEM SIMULATION OF RIVER-ESTUARINE PRODUCTIVITY RELATIONSHIPS,**  
D.C. Cooper.  
Verhandlungen Internationale Vereinigung Limnologie, Vol 18, p 236-249, 1972. 16 fig, 1 tab, 31 ref.

Descriptors: \*Rivers, \*Estuaries, \*Ecosystems, \*Model studies, \*Productivity, Texas, Freshwater, Salinity, Biological communities, Nutrients, Dams, Energy budget, Water pollution effects.

Identifiers: \*Microecosystems, Galveston Bay(Texas), Trinity River(Texas).

This research was designed to predict the potential responses of Galveston Bay to freshwater input reduction which would increase freshwater retention time, 15% of Houston Ship Channel effluent entering continuously into the estuarine headwaters, and simultaneous application of both stresses. Since these responses could not be investigated directly, the effects of a simulated freshwater impoundment and simulated Houston Ship Channel diversions into estuarine headwaters were investigated on a group of six continuous-culture microecosystem simulations of Galveston Bay. The expected general responses of the bay ecosystem to dam construction near the mouth of the Trinity River are increasing salinity, reduced import and export of organic carbon, greater proportion of nutrients bound in living form, shift in community metabolism from heterotrophy toward autotrophy, reductions in both primary and secondary productivity, and reduction in the estuarine ecosystem's efficiency at converting incoming energy into useful work and/or products. Simultaneous diversion of Houston Ship Channel effluent to the headwaters of Galveston Bay can be expected to be assimilated primarily in the most important nursery areas of the bay. Phytoplankton and zooplankton species diversity throughout the estuary will be reduced; this effect will be most intense in estuarine headwaters. (Jones-Wisconsin) W75-10099

**SEAGRASS ECOSYSTEMS. RECOMMENDATIONS FOR RESEARCH PROGRAMS.**  
Available from the National Technical Information Service, Springfield, Va 22161 as PB-233 982, \$3.75 in paper copy, \$2.25 in microfiche. Proceedings of the International Seagrass Workshop, October 22-26, 1973, Leiden, The Netherlands. 62 p.

Descriptors: \*Marine plants, \*Coasts, \*Ecosystems, \*Grasses, \*Investigations, International commissions, Information exchange, Conferences.  
Identifiers: \*Seagrass, International Seagrass Workshop.

The International Seagrass Workshop was concerned about the lack of knowledge as to the significance of seagrass systems to coastal ocean ecology. Because of the worldwide shallow water distribution of seagrass ecosystems, their nourishment of marine species and fisheries, their vulnerability to environmental perturbation, five different working groups proposed recommendations for research with background notes that together constitute a framework for an interdisciplinary program of study on these ecosystems. Relationships between food and feeding habits are largely unknown but necessary for an understanding of these communities. Although the impact of natural

## WATER CYCLE—Field 2

### Estuaries—Group 2L

catastrophes in oceans is intense, little is known about cause and effect relationships or of practical measures which would minimize them. Mechanisms by which seagrasses stabilize coastal sediments are not understood nor are the methods of recolonization or transplantation. Seagrass productivity is among the highest in the world, but measuring techniques are unavailable and the mechanisms that sustain the high productivity are unknown, nor is their global distribution. The effects of pollutants on these ecosystems are obscure. Recommendations for research areas and methodology are discussed and the needs for interdisciplinary and international cooperation. (See W75-10107 thru W75-10111) (Auen-Wisconsin) W75-10106

#### PRODUCTIVITY/PHYSIOLOGY WORKING GROUP,

Texas Univ. at Austin. Dept. of Botany.  
C. McMillan, and C. P. McRoy.

In: 'Seagrass Ecosystems. Recommendations for Research Programs,' Proceedings of the International Seagrass Workshop, October 22-26, 1973, Leiden, The Netherlands, p 5-12. 2 ref.

Descriptors: \*Marine plants, \*Grasses, \*Ecosystems, \*Measurement, \*Productivity, Trace elements, Primary productivity, Biomass, Cultures, Plant growth substances, Investigations, Coasts, Oceans, Plant physiology, Benthic flora, Nutrients, Standing crops, Data collections, Rooted aquatic plants, Sea water, Plant morphology, Climatic zones.

Identifiers: \*Seagrass, International Seagrass Workshop.

The Physiology Working Group on seagrass productivity discussed the problems of measuring the productivity of seagrass meadows and proposed guidelines and recommendations for areas of research. The complex ecology of primary production in a seagrass meadow includes the seagrasses, microepiphytic and macroepiphytic algae, benthic microalgae and macroalgae, and phytoplankton, but no single study has measured all these components of organic matter formation in a seagrass meadow. The reported productivity for seagrass alone ranges between 10 and 20 g of carbon fixed/sq m/day, and with the addition of other components of the ecosystem it would indicate that seagrass meadows must be one of the most productive systems on earth. The problem of primary production measurements in this ecosystem are in obtaining good estimates on a regional and global scale, and in the methodology for productivity measurements on a physiological level. Although the recommendations for productivity measurements do not include phytoplankton, nonetheless phytoplankton productivity should be included in the total seagrass ecosystem measurements. Specific recommendations are given for investigations of nutrients, trace metals, plant growth substances that may act as repellents to grazers, environmental tolerance limits, morphology, laboratory culture, and species composition in different geographic regions. (See also W75-10106) (Auen-Wisconsin) W75-10107

#### DECOMPOSITION WORKING GROUP,

Aarhus Univ. (Denmark). Lab. of Ecology.

T. Fenchel.

In: 'Seagrass Ecosystems. Recommendations for Research Programs,' Proceedings of the International Seagrass Workshop, October 22-26, 1973, Leiden, The Netherlands, p 25-37. 3 fig, 3 ref.

Descriptors: \*Marine plants, \*Detritus, \*Grasses, \*Cycling nutrients, Shallow water, Decomposing organic matter, Organic matter, Coasts, Nutrients, Investigations, Aquatic productivity, Nitrogen, Phosphorus, Sediments, Aquatic bacteria, Oceans.

Identifiers: \*Seagrass, International Seagrass Workshop.

Studies of detrital decomposition in sediments must be undertaken before mechanisms and importance of nutrient regeneration in sustaining primary production in seagrass ecosystems can be assessed. Flux of nitrogen and phosphorus between sediment and plants should be studied and techniques developed for separation, identification, and determination of nitrogen forms. Nature of microflora involved in metabolism, overall rates of release during metabolite decomposition from materials entering the sediment, fate of released dissolved organic compounds and organo-inorganic complexes, and loss of refractory molecules to permanent sediment should be studied by radioactive labeling of seagrasses. Anaerobic decomposition rates in particulate detritus should be determined in situ. Dissolved organic matter should be studied in relation to specific decomposition processes, rate processes of progressive degradation of dissolved organic components, bacterial succession of physiological degradation, indirect functional interactions of organic compounds with metals, and loss mechanisms as dissolved organic matter is degraded. Rate of physically dissolved organic matter loss from generation and degradation sites must be evaluated. Symbiotic relationships of epiphytic bacteria to angiosperm secretion of dissolved organic matter should be evaluated. Decomposer food chains are discussed. (See also W75-10106) (Buchanan-Davidson-Wisconsin) W75-10109

#### CONSUMER ECOLOGY WORKING GROUP,

Amakusa Marine Biological Lab., Tomioka (Japan).

T. Kikuchi, and J. M. Peres.

In: 'Seagrass Ecosystems. Recommendations for Research Programs,' Proceedings of the International Seagrass Workshop, October 22-26, 1973, Leiden, The Netherlands, p 41-45.

Descriptors: \*Primary productivity, \*Marine plants, \*Energy transfer, \*Grasses, Biological communities, Ecosystems, Shallow water, Habitats, Investigations, Food chains, Coasts, Balance of nature, Oceans.

Identifiers: \*Seagrass, International Seagrass Workshop.

The task of the Consumer Ecology Working Group was to determine areas of research as to the fate of the total primary production of the faunal communities in seagrass systems and the potential pathways. The several research areas required are: (1) What taxa are to be studied, based on the requirements that functional units of taxa must be defined with special attention given to feeding methods, modes of life, and microhabitats of organisms. (2) The population dynamics of at least some dominant components of the ecosystem must be studied separately to evaluate the total population dynamics. (3) Analysis of the qualitative aspects of feeding, i.e., food preferences of communities and their modification by food availability or other conditions. (4) The amount of food consumed and assimilated should be based on physiological and autecological characteristics of consumers and evaluation of energy trophic levels via metabolites, secreted materials, excretion, and feces. (6) The non-energetic relationships among and also between trophic levels, e.g., shelter, competition, and toxic effects. A framework for research of these areas is given as well as investigative techniques. (See also W75-10106) (Auen-Wisconsin) W75-10110

#### OCEANOGRAPHY,

Alaska Univ., College. Inst. of Marine Science.

D. C. Burrell.

In: 'Seagrass Ecosystems. Recommendations for Research Programs,' Proceedings of the International Seagrass Workshop, October 22-26, 1973, Leiden, The Netherlands, p 47-52.

Descriptors: \*Marine plants, \*Grasses, \*Ecosystems, Investigations, Sedimentology, Shores, Environmental effects, Revegetation, Habitats, Nutrients, Latitudinal studies, Nutrient requirements, Coasts, Sediments, Oceans, Vegetation establishment, Trace elements, Pollutants, Shallow water, Water circulation, Plant physiology, Thermodynamic behavior, Physicochemical properties.

Identifiers: \*Seagrass, International Seagrass Workshop.

The scope of investigations necessary to understand the ecology of seagrass is delineated. A major requirement is to understand why certain near-shore areas, especially territory adjacent to existing beds, do not support seagrass growth. The varying ability of specific geological environments to promote recolonization, and the rates at which this occurs, are particularly important for successful seagrass transplantation programs. There is a paucity of information for both the effects of severe storms or dredging operations on seagrasses and for their possible uses to decrease the impact of such events. Research areas on sedimentological conditions are described. The total cyclical behavior of the primary nutrients, nitrogen and phosphorus, should be studied. Special attention should be given to flux rates and the nature of intermediate nutrient species. The major and trace organic chemistry of various seagrass species should be characterized. Cycling of both physiologically and non-physiologically required trace metals should be studied and the effects of chemical pollutants investigated. The hydrodynamics associated with the colonization and maintenance of seagrass stands and the effect of seagrass beds on shallow water circulation patterns require investigation together with the environmental limits of seagrass meadows with respect to temperature, salinity, depth, etc. Recommendations are given for investigative approaches. (See also W75-10106) (Auen-Wisconsin) W75-10111

#### CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1970-SEPTEMBER 1971,

Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 7C.  
W75-10153

#### NUMERICAL MODEL OF THE SALT-WEDGE REACH OF THE DUWAMISH RIVER ESTUARY, KING COUNTY, WASHINGTON,

Geological Survey, Tacoma, Wash.

For primary bibliographic entry see Field 5B.  
W75-10157

#### DETERMINISTIC MODEL OF DYNAMIC EUTROPHIC ESTUARY,

Air Products and Chemicals, Inc., Allentown, Pa.

For primary bibliographic entry see Field 5B.  
W75-10215

#### ESTIMATES OF OIL IN AQUATIC SEDIMENTS BY FLUORESCENCE SPECTROSCOPY,

Bedford Inst., Dartmouth (Nova Scotia).

For primary bibliographic entry see Field 5A.  
W75-10235

#### THE INFRARED STUDIES OF SANTA BARBARA CHANNEL OIL SPILL,

Cincinnati Univ., Ohio.

For primary bibliographic entry see Field 5A.  
W75-10237

#### EXTRACTION OF PETROLEUM HYDROCARBONS FROM OIL-CONTAMINATED SEDIMENTS,

Maryland Univ., College Park. Dept. of Microbiology.

For primary bibliographic entry see Field 5G.

## Field 2—WATER CYCLE

### Group 2L—Estuaries

W75-10241

**TRED AVON RIVER, TALBOT COUNTY, MARYLAND (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineering District, Baltimore, Md.  
For primary bibliographic entry see Field 4A.  
W75-10295

**REGIONALISM AND THE LAW OF THE SEA: THE CASE OF SEMI-ENCLOSED SEAS.**  
Rhode Island Univ., Kingston.  
For primary bibliographic entry see Field 6E.  
W75-10301

**THE PUBLIC TRUST DOCTRINE AND THE CALIFORNIA COASTLINE,**  
San Diego State Univ., Calif.  
For primary bibliographic entry see Field 6E.  
W75-10305

**PAMLICO RIVER ESTUARY—PAST, PRESENT AND FUTURE,**  
North Carolina State Univ., Raleigh. Dept. of Zoology.  
J. E. Hobbie, and B. J. Copeland.  
Water Resources Institute Research Special, February 1973. 4 p, 1 fig, 7 ref. OWRT B-020-NC(3).

Descriptors: \*Estuaries, \*Estuarine environment, \*Marine fisheries, \*Rivers, \*Water resources, Aquatic environment, Environment, Estuarine fisheries, Bays, Inlets(Waterways), Intertidal areas, Saline water-freshwater interfaces, Sea water, \*North Carolina, Fish, Water sports, Natural resources, Projects, Nutrients, Nitrogen, Dams.  
Identifiers: \*Coastal water, Coastal zone management, Dam effects, Environmental policy, Non-point sources(Pollution), \*Pamlico River estuary(NC).

Researchers have studied the Pamlico River Estuary since 1966; the area is a biologically rich estuary that serves as a nursery ground for many kinds of fish and shellfish. Although considerable algae is present, the water is clean enough for water sports and recreation. As eastern North Carolina experiences increases in population, industry and agriculture, the authors fear that the area will drastically change and that a valuable resource will be lost. After presenting a detailed description of the marine environment, the article suggests several modes for preserving existing conditions. First, it is suggested that nutrient input should remain constant and that circulation and runoff patterns remain unchanged. Second, the authors recommend that increased nutrient loading of nitrogen should be prevented, and finally, that the effects of dams be carefully studied before any action is taken. The article concludes that the risks of possible changes must be weighed against the benefits of maintaining the area's present status. (Fernandez-Florida)  
W75-10338

## 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

**DESALTING PLANTS INVENTORY, REPORT NO. 5,**  
Hawaii Univ., Honolulu. Coll. of Business Administration.  
N. A. El-Ramly, and C. F. Congdon.  
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 556, \$4.75 in paper copy, \$2.25 in microfiche. Office of

Water Research and Technology, March 1975. 80 p, 4 tab. 14-30-3286.

Descriptors: \*Desalination plants, \*Census, \*Treatment facilities, \*Distillation, \*Membrane process, Freezing, Desalination processes, Water treatment, Waste water treatment, Water supply.  
Identifiers: \*Combined capacity(Desalting plants).

According to information received from desalting plant manufacturers, there are 1036 land-based desalting plants with capacities of at least 25,000 gallons-per-day in operation or being constructed throughout the world as of January 1, 1975. These plants are capable of producing about 526 million gallons of fresh water daily for cities and industries. Distillation processes are most widely used, accounting for about eighty-five percent of total capacity. The balance is almost entirely membrane processes with freezing accounting for less than one-tenth of one percent. During the three year period 1972-1974, since the previous Inventory Report was prepared, world-wide sales of desalting plants 25,000 gallons-per-day was reported as 408 plants with a combined capacity of 198 million gallons daily. Of these, 124 distillation plants with a combined capacity of 144 million gallons-per-day and 283 membrane plants with a combined capacity of 54 million gallons-per-day were reported. During the period only one freezing plant was reported. Plants retired from operation were deleted.  
W75-09852

**MEANS FOR AND METHOD OF PURIFYING CONTAMINATED WATER,**  
R. J. Campbell.  
U.S Patent No 3,885,399, 4 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 934, No 4, p 1379, May 27, 1975.

Descriptors: \*Patents, \*Water purification, Water quality control, Sea water, Brackish water, Flash freezing, \*Desalination, Crystallization, Separation techniques, Desalination apparatus, Waste water treatment.  
Identifiers: \*Freeze crystallization process.

An apparatus and method is described of purifying contaminated water by means of a two-step freeze crystallization process. The process avoids the problem of water freezing on the screen of the work column by reducing the temperature difference between the work water and the concentrate in the work column. The dilute concentrate from one stage is utilized as work water for the stage that contains concentrated concentrate. (Sinha-OEIS)  
W75-09864

**REVERSE OSMOSIS SYSTEM WITH AUTOMATIC VALVE FOR MODULE OPERATION CONTROL,**  
Desalination Systems, Inc., Escondido, Calif. (assignee)  
D. T. Bray.  
U.S Patent No 3,887,463, 5 p, 4 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 293, June 3, 1975.

Descriptors: \*Patents, \*Reverse osmosis, \*Semi-permeable membranes, \*Water quality control, Water storage, Water purification, Water treatment, Equipment, Valves, \*Desalination.

The invention comprises a reverse osmosis system in which purified water from a semipermeable membrane-containing module is stored in a container under fluctuating, elevated pressure. Pressurized feed water flow into the module is shut off by an automatic valve when the pressure in the storage container rises above a first predetermined value, and flow is restored by the automatic valve when pressure in the storage container drops below a second and lower pressure caused by withdrawal of purified water for use. The restoration or turn-on pressure is a predetermined proportion

of the feed water pressure and the shut-off pressure is related to or a proportion of the turn-on pressure. The automatic valve has a body with a first internal cavity; a central internal cavity of effective cross sectional area smaller than that of the first cavity; and a third internal cavity having an opening leading to the central cavity of area smaller than the central cavity. Movable seals span the effective cross sectional areas of the first and central cavities. A third movable seal opens the third cavity to the central cavity. (Sinha-OEIS)  
W75-09877

**WASTE-HEAT STEAM RUNS EVAPORATIVE WATER PURIFIER.**  
For primary bibliographic entry see Field 5D.  
W75-10240

### 3B. Water Yield Improvement

**APPARATUS FOR CONTROLLING THE LEVEL OF SUBSURFACE WATER,**  
Moretrench American Corp., Rockaway, N.J. (assignee)  
For primary bibliographic entry see Field 4B.  
W75-09880

**PROCEEDINGS OF THE WORLD METEOROLOGICAL ORGANIZATION/INTERNATIONAL ASSOCIATION OF METEOROLOGY AND ATMOSPHERIC PHYSICS SCIENTIFIC CONFERENCE ON WEATHER MODIFICATION.**  
World Meteorological Organization, Geneva (Switzerland).

Conference held October 1-7, 1973., Tashkent (USSR). WMO No 399, Geneva (Switzerland), 1974. 538 p.

Descriptors: \*Conferences, \*Weather modification, \*Hail, \*Snow, \*Rain, \*Meteorology, \*Fog, Snowfall, Cloud seeding, Artificial precipitation, Storms, Precipitation(Atmospheric), Cloud physics, Hurricanes, Thunderstorms, On-site investigations, Simulation analysis, Analytical techniques, Statistical methods, Evaluation, Clouds, Nucleation, Instrumentation.  
Identifiers: Hail suppression, Fog dispersal.

Weather modification is an art. Proceedings as a whole serve to show the dilemma facing practitioners of weather modification, namely the need to interfere with meteorological phenomena, without having sufficient basic knowledge about the processes involved. Broad subjects discussed were fog dispersal; rain enhancement; snow enhancement; hail suppression; modification of tropical storms and thunderstorms; technical and operational aspects of weather modification; physical, statistical, and economic evaluations of weather modification; and ice nuclei technology. (See W75-09945 thru W75-10002) (Humphreys-ISWS)  
W75-09944

**FOG DISPERSAL - PHYSICAL AND TECHNOLOGICAL ASPECTS,**  
Establishement d'Etudes et de Recherches Meteorologiques, Paris (France).  
L. Facy.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 3-11, 1974.

Descriptors: \*Fog, \*Weather modification, \*Methodology, Airports, Meteorology, Technology, Silver iodide, Drops(Fluids), Crystals, Ice, Nucleation, Supercooling, Condensation, Chemicals, Aerosols, Propane.

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Water Yield Improvement—Group 3B

Identifiers: \*Fog dissipation, \*Visibility improvement, Vaporization, Warm fogs, Cold fogs, Ice fogs, Collection efficiency, Helicopters, Freezing nuclei.

Fog dispersal techniques were reviewed. These techniques were summarized as follows: (1) In cold supercooled water fogs, use may be made of the thermodynamically metastable water phase by introducing natural or artificial ice or freezing nuclei. (2) In warm fogs, sufficient heat may be supplied with burners to vaporize the droplets and to provide an increase in air temperature for greater stability inside the clear space of air obtained. (3) In warm (or even cold) fogs, a sufficient amount of hygroscopic chemicals may be dispersed in order to lower the vapor pressure over the saturated droplets to make use of Raoult's law versus the remaining pure water droplets. (4) The collection efficiency of the droplets may be increased either by mechanical and/or electrical means or by surface behavior modification. (5) The clear dry air above may be mixed with the fog layer, if thin enough, by using fans or helicopters. (6) Ice fogs are the most difficult case. In principle, heat or filtration are theoretically the only ways of dissipating the ice crystals. But heat must be provided by dry or radiative devices in order not to inject additional water vapor. (See also W75-09944) (Sims-ISWS) W75-09945

**ON A METHOD OF FOG MODIFICATION BY PASSIVATION OF CONDENSATION NUCLEI,**  
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR). R. A. Bakhanova, and A. V. Silayev.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland). p 13-17, 1974. 5 fig, 23 ref.

Descriptors: \*Fog, \*Weather modification, \*Methodology, Nucleation, Condensation, Laboratory tests, Chemicals, Clouds, Adsorption, Alcohols, Ammonium compounds, Meteorology. Identifiers: \*Hygroscopic nuclei, Ammonium chloride, Cetyl alcohol, Passivation.

The idea of artificial modification of the activity of the cloud condensation nuclei with monolayers of some surface-active agents (SAA) was developed previously. Some attempts have been made to apply the SAA to prevent fog formation but the small number of these experiments and an ambiguity of their results do not permit any conclusions about the efficiency of this method. The effect of cetyl alcohol adsorption layers was studied for the early stages of condensation growth of hygroscopic nuclei (ammonium chloride). The modification of the nucleus' surface by cetyl alcohol was carried out by the adsorption of its molecules from the gas phase. Nuclei growth was observed. The experiments showed that the initial state of condensation nuclei is of great importance for the artificial reduction of their activity (the so-called passivation). The laboratory and theoretical results indicated that the method of passivation of the condensation nuclei may be operationally feasible in preventing fog formation. To apply this method a reliable forecast of fog formation is needed. Another difficulty is to choose the correct moment to introduce SAA vapor into the atmosphere. The quantity of SAA needed depends mainly upon the air mass temperature; for example, at 0°C, 5.5 kg per cubic kilometer is needed; at 5°C, the quantity needed is 10 kg; at 10°C, 25 kg; and at 20°C, 160 kg. (See also W75-09944) (Sims-ISWS) W75-09946

**DESIGN OF A MODERN THERMAL FOG DISSIPATION SYSTEM FOR AIRPORTS,**  
Air Force Cambridge Research Labs., Hanscom AFB, Mass. B. A. Silverman, and A. I. Weinstein.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 19-28, 1974. 2 fig, 5 tab, 9 ref.

Descriptors: \*Fog, \*Weather modification, \*Airports, Methodology, Design, Equipment, Technology, Heat, Fuels, Economics, Safety, Costs.

Identifiers: \*Visibility improvement, \*Warm fogs, Fog dissipation, Landing safety, Burners.

Cold fog accounts for only 5% of the total fog encountered on a worldwide basis, warm fog accounting for the other 95% of the cases. The direct application of heat from a well-engineered ground based system is the most practical and reliable technique for dissipating warm fog at airports where the volume of traffic justifies its installation. The U.S. Air Force has undertaken the development of a thermal fog dissipation system that is based on the application of modern meteorological and heat engineering technology. The design of this modern thermal fog dissipation system for airports was described. Operation of the thermal fog dispersal system will result in significant benefits in terms of improved operational effectiveness, improved cost effectiveness, improved operational safety, and net fuel economy. (See also W75-09944) (Sims-ISWS) W75-09947

#### PROBLEMS OF RADIATION FOG PREVENTION.

Akademija Nauk SSSR, Moscow. Institut Fizicheskoi Khimi. B. V. Derjaguin, I. N. Grigorenko, V. A. Ershov, I. A. Zolotarev, and Yu. S. Kurgin.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 29-33, 1974.

Descriptors: \*Fog, \*Weather modification, \*Methodology, Condensation, Nucleation, Mathematical studies, On-site investigations, Alcohols, Meteorology, Radiation. Identifiers: \*Passivation, Cetyl alcohol, USSR.

One possible method of affecting the formation of radiation fog consists of artificially reducing the condensation activity of nuclei by coating these with monolayers to reduce the vapor adsorption rate. In 1970-1971, experiments were carried out on a site located in the neighborhood of Barishevka, Kiev region. One group used as a chemical reagent a mixture of high-molecular alcohols of the Shebekinsk Chemical Combine, whose chemical composition included 95% of alcohols of C18-C22 fraction, whereas another group used cetyl alcohol. These experiments demonstrated the high efficiency of the passivation method involving the introduction of highly dispersed high-molecular alcohol into the atmosphere layer adjacent to the ground. In all cases thus treated, no formation of radiation fog was observed over the area having passivated condensation nuclei. (See also W75-09944) (Sims-ISWS) W75-09948

#### SOME DATA ABOUT THE MECHANISM OF THE ARTIFICIAL DISSIPATION OF SUPER-COOLED FOG.

Central Aerological Observatory, Moscow (USSR). L. I. Krasnovskaya, T. I. Shevaldina, and A. N. Hizhnjak.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 35-40, 1974. 4 fig, 8 ref.

Descriptors: \*Fog, \*Weather modification, \*Aerosols, Laboratory tests, Nucleation, Propane, Temperature, Carbon dioxide. Identifiers: \*Cloud chamber studies, Fog dissipation, Freon.

Data have been published during the past 15 years concerning the possibility of using propane for the artificial dissipation of fog at temperatures considerably higher than the threshold temperatures at which cooling reagents and ice-forming aerosols are active. The values obtained in field experiments for the threshold temperature at which propane is effective suggest that the properties of the active nuclei formed by introducing agents of this type into fog are different from those of ice crystals. It therefore seemed useful to conduct laboratory investigations aimed at verifying this hypothesis. The experiments were conducted in a cooling chamber with a working volume of 16 cu m. Comparisons were made of the quantities of active nuclei formed per gram of reagent introduced with liquid carbon dioxide, propane, and Freon-12 in temperatures ranging from -10°C to 0°C. Freon was chosen to represent reagents of the propane type; but it is much more convenient for experimental purposes because it is neither toxic nor explosive. In the temperature range from -10°C to -3°C, there was practically no difference in the action time of the reagents tested; but above -3°C there was a considerable difference. It can be assumed, therefore, that at such high temperatures, CO<sub>2</sub> acts only as a cold source and that the active nuclei formed when it is introduced are ice crystals. (See also W75-09944) (Sims-ISWS) W75-09949

**RAIN ENHANCEMENT - A REVIEW,**  
Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Cloud Physics. J. Warner.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 43-50, 1974. 1 tab, 7 ref.

Descriptors: \*Weather modification, \*Cloud seeding, \*Artificial precipitation, Cloud physics, Rain, Precipitation(Atmospheric), Nucleation, Rainfall, Chemistry of precipitation, Silver iodide, Meteorology, On-site investigations, \*Reviews.

Rain enhancement experiments in Australia, India, Israel, and the United States were reviewed. The good and bad features of these experiments were discussed. It was concluded that the following are necessary conditions for an experiment that will produce widely accepted results: (1) good statistical design and analysis of the experiment; (2) long-term continuity; (3) uniformity in cloud characteristics throughout the term of the experiment, or at least means of separating them; (4) a preponderance of clouds expected to be susceptible to the seeding technique employed; (5) sufficient background knowledge of the microphysics and dynamics of clouds in the area to enable the experimenter to accept or reject the statistical result. (See also W75-09944) (Sims-ISWS) W75-09950

#### RESULTS OF SEEDING CUMULONIMBUS CLOUDS AIMED AT THE MODIFICATION OF PRECIPITATION IN THE STEPPE PART OF THE UKRAINE,

Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR). F. Ya. Voit, E. E. Kornienko, I. A. Kurejko, A. I. Furman, and S. B. Husid.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 51-54, 1974. 1 tab, 12 ref.

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3B—Water Yield Improvement

Descriptors: \*Weather modification, \*Cloud seeding, \*Artificial precipitation, Cloud physics, Rainfall, Rain, Precipitation(Atmospheric), Silver iodide, Nucleation, Clouds, Meteorology. Identifiers: \*Cumulonimbus clouds, USSR(Ukraine).

Over a number of years, cumulus congestus clouds were seeded in the steppe part of the Ukraine in order to influence the amount of precipitation produced. As a result of randomized experiments during 1966-1968, it was found that seeding these clouds with dry ice resulted in a marked increase in precipitation from them, although the absolute increase in precipitation was not large. Seeding of cumulonimbus clouds began in 1972. Experiments were carried out over the experimental meteorological polygon of the Ukr-NIGMI (area 10,000 sq km). The cloud seeding was performed by means of an Australian-made generator of silver iodide installed in an IL-14 aircraft. Monitoring of the operation was by means of a network of raingages and a MRL-I radar of wavelength 3.2 cm. A cumulonimbus cloud or system of clouds was selected as an experimental unit. Aircraft took off on days when showers were forecast. A violently growing cloud or a group of closely spaced clouds with a small initial depth was chosen from the aircraft. Seeding took place at the cloud base, in the area of updraughts, and stopped when the cloud transformed into cumulonimbus and precipitation started. Positive results of seeding were indicated and the observed increase in precipitation was impressive. (See also W75-09944) (Sims-ISWS) W75-09951

**SALT DRIZZLES EXTRACTED FROM UNSATURATED AIR LAYERS BY SEEDING WITH HYDROSCOPIC NUCLEI,**  
Université de Bretagne-Occidentale, Brest (France).

R. Serpolay, and M. Andro.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 55-61, 1974. 5 fig, 4 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Drizzle, Atmospheric physics, Fog, Salts, Nucleation, Sodium chloride, Precipitation(Atmospheric), Rainfall, Meteorology. Identifiers: \*Hydroscopic nuclei.

For studying the possibility of modifying fogs, an experimental ground-based device was proposed. It consists of a set of units, each of them being able to disperse suitably powdered hydroscopic material into the atmosphere. By thus dispersing a powder of NaCl, it has been possible to induce locally a drizzle in fog layers of depths between 40 and 60 m. The precipitation was observed very accurately at a distance less than 300 m leeward of the device, corresponding to a residence duration of about 4 minutes for the airborne particles. In order to increase the number of data resulting from field experiments, seedings were carried in uncloudy air layers whose relative humidity were between 100% and 75%, the latter value corresponding to the critical relative humidity for sodium chloride. All the seedings conducted in uncloudy conditions with relative humidity between 100% and 75% induced saline drizzles similar to those previously obtained by seeding the fog layers with the same ground-based device. In the case of drizzle droplets generated in moist air, it appears that the higher the relative humidity of the air in which the drizzle has been induced, the higher the percentage of the large-sized droplets. It appears that aerosols of hydroscopic particles are capable of inducing precipitation in clear as well as in cloudy conditions. (See also W75-09944) (Sims-ISWS)

W75-09952

**RAPID INDUCEMENT OF PRECIPITATION BY SEEDING STRATIFIED AIR LAYERS,**  
Université de Bretagne-Occidentale, Brest (France).

R. Serpolay, and M. Andro.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 63-67, 1974. 6 ref.

Descriptors: \*Precipitation(Atmospheric), \*Weather modification, \*Cloud seeding, Meteorology, Artificial precipitation, Rainfall, Nucleation, Ice, Crystals, On-site investigations, Fog. Identifiers: Hygroscopic seeding.

The medium-scale trials carried out at Brest-Guipavas Airport make use of the action of the hydroscopic particles on air layers where clouds are present or in which the humidity is close to saturation point. The results indicate that precipitation develops rapidly after seeding. With the speed of displacement of the air layers treated in this way, precipitation occurs at only a few hundred meters from the source of the nuclei. The size of the residual crystals which are left after evaporation of water from the precipitating saline droplets is, on the average, 4 to 10 times that of the nuclei used for seeding. In a series of experiments with super-cooled fogs seeded by using ice crystals produced in the spray of a refrigerating liquid, all the conditions seeming to prevail for a rapid formation of precipitation were listed. It was concluded that the following three conditions must be fulfilled: (1) temperature of the order of -4°C or below; (2) high concentration of ice crystals equally competitive for the process of water vapor transfer and immediately available for this process on leaving the injecting device; (3) turbulent flow of the cloudy atmosphere, often occurring with a wind speed of at least 3 m/s or caused by eddies. The rapid growth of precipitation elements has often been attributed to the third condition only because it is observed regularly and systematically. (See also W75-09944) (Ochs-ISWS) W75-09953

**ON THE EFFICIENT SIZE AND CONCENTRATION OF SPRAY DROPS FOR STIMULATING WARM CLOUDS,**  
Japan Meteorological Agency, Tokyo. Aerological Observatory.

Y. Takahashi.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 69-80, 1974. 5 fig, 9 ref.

Descriptors: \*Precipitation(Atmospheric), \*Weather modification, \*Cloud seeding, Meteorology, Drizzle, Artificial precipitation, Rainfall, Nucleation, Drops(Fluids), Clouds. Identifiers: Hygroscopic seeding.

Cloud droplets which have grown beyond a certain size by condensation in ascending air, and whose inertia of motion against the air have become significant will begin rapidly to grow to small drops or drizzle through mutual collisions due to turbulence, whether they are of equal size or not. Drizzle thus formed consists of drops of various sizes according to the number of collisions. Some grow raindrops by capture of lots of cloud droplets before leaving the cloud. If the cloud is shallow and no significant updraught exists, drizzle falls from the cloud. An equation for the probability of equal sized drops colliding in turbulence was presented and the radius at which cloud droplets may begin rapid growth by collision was found to be about 25 microns radius. The critical concentration of these drops was also determined to be at about 0.2 grams per cu m. The time required to

form drizzle was also discussed. Spray drops for enhancing precipitation in warm clouds should have a distribution of size close to or somewhat larger than the critical size, say 25 microns in radius, and delivery of spray should preferably be where the mass concentration of big cloud droplets is approaching the critical value, say 0.2 or 0.25 grams per cu m. (See also W75-09944) (Ochs-ISWS) W75-09954

**NUMERICAL SIMULATION OF CLOUD SEEDING EXPERIMENTS,**  
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences. For primary bibliographic entry see Field 2B. W75-09955

**THEORETICAL RESEARCH INTO ARTIFICIAL STIMULATION OF PRECIPITATION FOR FIGHTING FOREST FIRES,**  
Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Leningrad (USSR). For primary bibliographic entry see Field 2B. W75-09956

**FEASIBILITY OF MESO- AND SYNOPTIC-SCALE WEATHER MODIFICATION FROM CARBON PARTICLE SEEDING,**  
Colorado State Univ., Fort Collins.

W. M. Gray, and W. M. Frank.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 95-102, 1974. 2 fig, 2 tab, 13 ref.

Descriptors: \*Feasibility studies, \*Weather modification, \*Artificial precipitation, \*Atmospheric physics, Carbon, Heating, Solar radiation, Convection, Evaporation, Effects, Boundary layers, Meteorology, Economics. Identifiers: \*Carbon black dust, Mesoscale effects.

A new area of potential weather modification—mesoscale weather modification from solar energy interception by small carbon particles—was described. If a significant portion of the incoming solar energy over the oceans could be absorbed in the atmospheric boundary layer during the daylight hours, an artificial stimulation of cumulus convection would occur. This might be accomplished by aerosol interception of solar radiation. It is envisaged that this mesoscale artificial heat source will be utilized to produce or intensify a mesoscale upward vertical motion field which will stimulate extra cumulus convection. This mesoscale heat source should produce or intensity the lower level mass and water vapor convergence fields. An enhancement of cumulus convection should follow. If tropospheric vertical wind shears are not too large, it is likely that this extra induced cumulus convection will act as a 'feedback' mechanism to develop or intensify a mesoscale weather system or cloud cluster. This weather system is likely to exist after the termination of the extra solar heating. It may prove beneficial to employ both the 'carbon dust' and the 'silver iodide' modification techniques. The carbon dust technique could be used to generate cumulus and the 'silver iodide' technique at a later time to enhance the cumulus. (See also W75-09944) (Sims-ISWS) W75-09957

**THE ROLE OF SOLID PRECIPITATION ELEMENTS IN NATURAL AND ARTIFICIAL PRODUCTION OF RAIN IN ISRAEL,**  
Hebrew Univ., Jerusalem (Israel). Dept. of Atmospheric Sciences.

A. Gagin, and I. Steinhorn.

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Water Yield Improvement—Group 3B

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 103-124, 1974. 5 fig, 2 tab, 23 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Cloud seeding, Cloud physics, Atmospheric physics, Silver iodide, Nucleation, Rainfall, Precipitation(Atmospheric), Meteorology, On-site investigations.

Identifiers: \*Israel.

The rain bearing, wintertime, subtropical cumuli of Israel are predominantly mixed clouds. Their model cloud-top temperature is -20°C whereas cloud base temperatures are 9°C, on the average. Consequently, values of maximum liquid water contents in the upper parts of each of these clouds were found to be normally in the range of 0.7-1.5 g/cu m, depending on the size of the clouds. Extensive measurements of icy crystal concentrations in the vicinity of cloud tops indicate that these concentrations correspond to the ice nuclei concentrations active at the same temperatures and are thus clearly temperature dependent. The physical plausibility of the statistically significant, positive effects, that were obtained in both the first and second Israeli cloud seeding experiments was assessed. In the absence of an alternative rain-forming process, normal ice crystal formation and its subsequent growth by accretion was shown to be capable of producing precipitation sized particles in Cu clouds that have top temperatures colder than -12°C (equivalent to a cloud 3.25 kg deep). The size and concentration of precipitation elements in the various clouds are proportional to the depth of the clouds and their top temperature. The computer values of the duration of precipitation and the time for its full development were in a good agreement with the corresponding values observed by radar. Clouds, having top temperatures warmer than -12°C are unlikely to be affected by seeding with AgI particles having a threshold activation temperature of -5°C. Cu clouds having top temperatures in the range of -12°C to -20°C seem to be mostly favorable to the type of seeding discussed. (See also W75-09944) (Sims-ISWS) W75-09958

**SNOWFALL ENHANCEMENT,**  
National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.  
For primary bibliographic entry see Field 2C.  
W75-09959

**THE EXPERIMENTAL SEEDING OF FRONTAL CLOUDS IN WINTER IN ORDER TO INCREASE PRECIPITATION,**  
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).  
B. N. Leskov.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 143-147, 1974. 3 fig, 15 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Cloud seeding, Rainfall, Winter, Precipitation(Atmospheric), Nucleation, Clouds, Carbon dioxide, Cloud physics, Atmospheric physics, Meteorology, On-site investigations.

Identifiers: \*Frontal clouds, USSR.

The results obtained from seeding of frontal clouds in winter were discussed. Used as a reagent, solid carbon dioxide was introduced from an airplane into layers suitable for seeding. Each layer's vertical thickness was not less than 250-300 m while the temperature did not exceed -4°C. The experiment was performed so as to seed all the flowing cloud. The seeding line was fixed relative

to the ground, so as to make the artificial precipitation occur within the experimental area. The results of 77 experiments were analyzed and can be divided into two kinds: (1) 61 events incorporating experiments with naturally precipitating frontal clouds; (2) 16 events where nonprecipitating frontal clouds of Sc, Ac, As types were seeded. The average relative increase in the experiments of the first group was 100%. Such a large increase in precipitation was attained because only a definite type of cloud with layers suitable for treatment was seeded. In the case of precipitating clouds, such layers were observed only in 42% of the events. Out of the 16 experiments of group 2, only in 8 events were the artificial precipitation areas obtained. The results show that treatment of frontal clouds by solid carbon dioxide causes a substantial transformation. It is characterized by a change of the phase state of drop and mixed layers, by an increase in crystal concentrations, and by raising of the temperature. This should cause dynamic disturbances, as well as a change in the precipitation amount. (See also W75-09944) (Sims-ISWS) W75-09960

#### GROUND-BASED CLOUD SEEDING EXPERIMENT AT DELHI DURING WINTER,

Institute of Tropical Meteorology, Poona (India). R. K. Kapoor, R. N. Chatterjee, K. K. Kanuga, S. K. Paul, and Bh. V. Murty.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 149-158, 1974. 1 fig, 5 tab, 12 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Cloud seeding, Rainfall, Winter, Precipitation(Atmospheric), Nucleation, Silver iodide, Climatology, Meteorology, On-site investigations.

Identifiers: \*Ground-based seeding, India.

A series of ground-based experiments, which relate to winter cloud seeding with silver iodide as a seeding agent, has been in progress at Delhi since 1968. The details of these experiments, which are to continue, and the results obtained so far were presented. The solution used for seeding, in the first 4 of the 5 seasons, was prepared by dissolving silver iodide in acetone with sodium iodide as a solubilizer. It contained about 7% silver iodide by weight. The solution used in the fifth season contained ammonium iodide as solubilizer in place of sodium iodide. The period of experiment has been the four winter months, December to March. The seed-generator has been operated on each seeding day for about four hours during the hottest part of the day, i.e., between 1100 and 1600 IST. The rainfall in the target sector, on a seasonal scale, increased. However, the positive result obtained cannot be accepted as conclusive, unless the same trend continues to be shown by experiments in the next few seasons. (See also W75-09944) (Sims-ISWS) W75-09961

#### THE ARTIFICIAL MODIFICATION OF CLOUDS AND PRECIPITATION IN A MOUNTAINOUS REGION,

Washington Univ., Seattle. Dept. of Atmospheric Sciences.

P. V. Hobbs, and L. F. Radke.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 159-167, 1974. 3 fig, 1 tab, 9 ref. NSF Grant GI-31759, Dept. of Int. Contract 14-06-D-6999.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Cloud seeding, \*Mountains,

Nucleation, Atmosphere, Silver iodide, Carbon dioxide, Precipitation(Atmospheric), Model studies, Mathematical models, Atmospheric physics, Cloud physics, Meteorology, Theoretical analysis, On-site investigations, Washington.

Identifiers: Cascade project, Cascade Mountains(Wash).

In 1969 the Cloud Physics Group at the University of Washington commenced a program of research to investigate the dynamics and microstructure of winter storms over the Cascade Mountains. The program involves extensive measurements both on the ground and in the air, the development of a theoretical model to describe the airflow over the Cascades and the growth and fallout of precipitation, and investigations into the effects on the microstructure of the clouds and on precipitation at the ground of introducing artificial ice nuclei directly into clouds with particular emphasis on diverting snowfall from the western slopes of the Cascades to the drier eastern slopes. An outline was given of the theoretical basis of the project and the experimental techniques that are being used in the field studies. Emphasis was placed on observations and measurements obtained when artificial seeding was carried out and on current conclusions concerning the effectiveness of this technique for modifying the distribution of snowfall across a mountain range. (See also W75-09944) (Sims-ISWS) W75-09962

#### SEEDING REQUIREMENTS FOR RAPID GLACIATION OR STIMULATION OF A MIXED PHASE CLOUD,

State Univ. of New York, Albany. Atmospheric Sciences Research Center.

J. E. Justo.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 169-178, 1974. 4 fig, 4 tab, 13 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Mathematical models, Model studies, Cloud physics, Atmospheric physics, Nucleation, Cloud seeding, Crystals, Ice, Supersaturation, Glaciation, Meteorology.

Frequently, there are not enough ice nuclei present for partial or complete glaciation of super-cooled clouds. This is especially true of highly convective systems where the supply rate of water vapor can exceed the extraction rate by deposition onto available ice crystals. There is a critical concentration of ice crystals beyond which a cloud will glaciate. This concentration, which varies with cloud updraft strength, temperature, and crystal size and type is important in the development of natural and seeded clouds. An equation was previously developed to estimate the number of nuclei necessary to rapidly glaciate a supercooled cloud. With more complete information on crystal growth rates now available, it is possible to refine these estimates for particular crystal types and for several pressure levels. The basic equation employed was that for supersaturation change with time in a mixed-phase cloud. Supersaturation in an all-water warm cloud has been expressed by several other investigators. This expression was extended to include the ice phase and to consider supersaturation with respect to ice. Some results of calculations using this equation were presented. Implications of these results as they relate to the concentrations of nuclei needed in cloud modification were listed. (See also W75-09944) (Sims-ISWS) W75-09963

#### THE PYRAMID PILOT CLOUD-SEEDING PROJECT,

Nevada Univ., Reno. Desert Research Inst.

J. A. Warburton.

### Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3B—Water Yield Improvement

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 179-186, 1974. 2 fig.

Descriptors: \*Weather modification, \*Cloud seeding, \*Artificial precipitation, \*Snowfall, Silver iodide, Nucleation, Precipitation(Atmospheric), Mountains, Radar, Water supply, Projects, Meteorology, Nevada.

Identifiers: Sierra Nevada, Pyramid Lake Pilot Cloud-Seeding Project, Reno(Nev.).

In early 1970, a serious water shortage and water rights problem emerged in western Nevada. The surface elevation of Pyramid Lake, an ancient desert lake, was observed to have fallen some 20 meters over a period of 60-70 years. Increased water usage, irrigation, and urban development had presumably contributed significantly to this drop in lake level. Concern for the preservation of the lake, site of an Indian reservation, on both environmental and economic grounds led to the commencement of the Pyramid Pilot Cloud-Seeding Project, a weather modification program designed to augment the inflow to the river system supplying water to the lake and the surrounding urban areas. The project area is being seeded with six ground-based AgI generators. A 3.2 cm lambda weather radar is being used for observations of the winter snowstorms. With the radar data in digital form, a great variety of analysis can be performed. The combination of rugged terrain and the need for the seeding material to flow over the Sierra crest line into the target area lying on the east down-slope side of the mountains provided a situation where it was important to measure the silver content of the precipitation falling in the project area. Observed concentrations of silver in the target precipitation are typically 4 to 10 times "background." (See also W75-09944) (Sims-ISWS) W75-09966

#### HAIL PROCESS INVESTIGATION AND HAIL SUPPRESSION ACTIVITIES IN THE U.S.S.R., Gidrometeorologicheskii Institut, Leningrad (USSR). High-Altitude Geophysics Inst. I. I. Burtsev, I. I. Gaivoronsky, and A. I. Kartsivadze.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 189-196, 1974. 1 tab.

Descriptors: \*Weather modification, \*Cloud seeding, \*Model studies, \*Hail, Storms, Cloud physics, Atmospheric physics, Mathematical models, Nucleation, Crystals, Precipitation(Atmospheric), Meteorology.

Identifiers: \*USSR.

In the past decade much success has been gained in the studies on hail formation and hail precipitation processes. As a result of these studies the possibilities of influencing the hail forming process have been learned. These studies were reviewed with particular emphasis given to the model studies of hailstorms in the USSR and elsewhere. The operational techniques used in the hail suppression activity in the USSR were described, and the results of these activities were summarized. Analysis of the results of hail suppression over 5 years shows a decrease by a factor of 3-4 both in relation to control areas and in comparison with many years' data obtained before protection. On the other hand, crops over wide areas are still damaged by hail. Analysis of the experience obtained in hail suppression work shows that the most considerable damage occurs during years of intensive hail processes or when hail clouds were not seeded or were seeded insufficiently. Efficiency evaluation both in the USSR and in other countries requires further improvement and verifica-

tion. Statistical methods and randomized experiments will result in more objectiveness as far as hail suppression evaluation is concerned. More and more attention is being given in the USSR, USA, France, Canada, and other countries to these problems. It would be more justifiable to carry out investigations and operational work cooperatively on the basis of the results already obtained. (See also W75-09944) (Sims-ISWS) W75-09965

#### NATURAL 'HAILCORES' AND THEIR ABILITIES TO ESTIMATE THE EFFICIENCY OF HAIL PREVENTION SYSTEMS, Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie. For primary bibliographic entry see Field 2B. W75-09966

#### HAILSTORMS IN JAPAN, National Research Center for Disaster Prevention, Tokyo (Japan). Y. Omoto.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 207-215, 1974. 9 fig, 1 tab, 11 ref.

Descriptors: \*Hail, \*Weather modification, \*Climatology, Cloud physics, Storms, Cloud seeding, Precipitation(Atmospheric), Meteorology.

Identifiers: \*Japan.

An essential part of a hail suppression research project is to obtain knowledge on the characteristics of hailstorms which occur in the area under consideration. In Japan, there had been relatively few studies on hail, especially before the mid-1960s. Between 1965 and 1969 the central and east-central portions of the main island, Honshu, suffered an unusually great amount of damage by hail. At about this time, the National Research Center for Disaster Prevention was planning to promote weather modification research in Japan, and the organization decided to choose hail suppression as object of the first field program. The main task of the project was the development of a suitable seeding rocket for use over land areas of Japan. Efforts to obtain basic meteorological knowledge on hailstorms had to be carried out simultaneously. Recent research results on various aspects of hailstorms in Japan were summarized. Considering the operational aspects of such a project and the climatology of hail-affected regions of Japan, operations using anti-aircraft guns or rockets from the ground seem impractical in Japan. Seeding by rockets launched from aircraft or pyrotechnic devices dropped from aircraft seems to be a more practical approach. Methods of seeding from aircraft flying under the storm cloud base are inadequate in Japan because cloud bases are relatively low over the mountainous regions. Further studies on hailstorms are required in order to make a conclusive decision on the feasibility of an operational hail suppression program in Japan. (See also W75-09944) (Sims-ISWS) W75-09967

#### RESEARCH INTO HAIL-FORMING PROCESSES AND THE RESULTS OF ANTI-HAIL PROTECTION MEASURES IN MOLDAVIA, Central Aerological Observatory, Moscow (USSR).

For primary bibliographic entry see Field 2B.

W75-09968

#### ON THE RESULTS OF PRACTICAL PROTECTION OF VALUABLE AGRICULTURAL CROPS FROM HAIL BY THE THRI (ZAKNIGMI)

#### METHOD (THE RESULTS OF FIVE YEARS' WORK, 1969-1973), Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tiflis (USSR).

V. P. Lominadze, I. T. Bartishvili, and Sh. L. Gudushauri.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 225-230, 1974. 2 tab, 29 ref.

Descriptors: \*Weather modification, \*Hail, \*Cloud seeding, Sodium chloride, Silver iodide, Methodology, Cloud physics, Agriculture, Crops, Meteorology, On-site investigations.

Identifiers: \*Hail suppression, USSR.

The Transcaucasian Hydrometeorological Research Institute (THRI) developed and used a method of active modification of hail processes which differs substantially in its principles from methods used by other investigators in the USSR. The method is based on the simultaneous application of hygroscopic and crystallizing reagents. The crystallizing reagents are used in comparatively small quantities, since the principal modification effects are achieved by the seeding of hygroscopic reagents into the warm part of the cloud. Sodium chloride particles are injected by means of anti-hail shells near the base of the cloud and at the mean level of the zone of increased radar reflectivity as hygroscopic reagent, and silver iodide is introduced into the supercooled part of the cloud in the zone of maximum radar reflectivity as crystallizing reagent. Results were presented of measures taken to protect agricultural crops over large areas from hail during 1969-1973. Special attention was drawn to 1972 when, despite the exceptional intensity and duration of potential hail-producing processes, protection was successful. In 1972, within the protected area, hail-damage to crops over an area of only 91 ha was recorded, while in the control area over 7979 ha suffered damage. It was determined that the hail-damage within the protected area was caused by a delay in starting operations. The effect of the protection measured by the THRI method was demonstrated by comparing the proportion of crops damaged in the protected and the control areas. Over the five years, crops in the protected area were damaged by hail to an extent amounting only to 2.4% of those damaged in the control area. (See also W75-09944) (Sims-ISWS) W75-09969

#### SIMULATION OF THE NATURAL PROCESS OF HAIL FORMATION AND ITS TRANSFORMATION UNDER THE INFLUENCE OF ARTIFICIAL CRYSTALLIZATION, Gidrometeorologicheskii Institut, Leningrad (USSR).

For primary bibliographic entry see Field 2B. W75-09970

#### REVIEW OF RECENT WORK ON HAIL SUPPRESSION IN BULGARIA, Bulgarian Academy of Sciences, Sofia. Inst. of Geophysics.

L. Krastanov, and K. Stantchev.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 239-241, 1974.

Descriptors: \*Weather modification, \*Hail, \*Cloud seeding, \*Programs, Precipitation(Atmospheric), Projects, Methodology, Artificial precipitation, Meteorology.

Identifiers: \*Hail suppression, \*Bulgaria.

Cooperational activities aimed at reducing or eliminating hail were initiated in 1968. Bulgarian

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### Water Yield Improvement—Group 3B

specialists, assisted by Georgian colleagues, prepared a program and proposed an organizational structure to deal with hail suppression. Experimental seeding began at the end of the 1969 hail season and was over an area of 3000 sq km. Investigations had to be made concerning the part of the convective cloud where the hail-forming process is expected to occur, and the way that this can be identified by radar. A relationship was sought between the thermodynamic factors of the atmosphere, the underlying surface and the direction of movement of the cloud. It was found that for optimum results the part of the cloud to be seeded is that where the temperature is about -13°C. This corresponds to a level where the temperature outside the cloud is -6.3°C. At present in Bulgaria, four polygons having a total area of more than 6000 sq km are protected; one of them is still in the experimental phase and another is being organized for operation during the next season. The degree of success achieved in each polygon is different depending on whether the Georgian methods were strictly applied, how thoroughly the local peculiarities were studied, and how high the level of training of the personnel had been. In two of the polygons where well-trained specialists are at work, having a combined protected area of more than 3000 sq km, damage by hail has decreased about sixfold. A side effect of the hail suppression projects is an apparent increase in the amount of precipitation by 8%. (See also W75-09944) (Sims-ISWS) W75-09971

**THE EXPERIMENTAL PROGRAM TO MODIFY HURRICANES,**  
National Hurricane Research Lab., Coral Gables, Fla.  
For primary bibliographic entry see Field 2B.  
W75-09972

#### DYNAMIC METHODS OF CONVECTIVE CLOUD MODIFICATION BY MEANS OF ARTIFICIAL VERTICAL JETS,

Institut Prikladnoi Geofiziki, Moscow (USSR).  
N. I. Vulfson, and L. M. Levin.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 255-263, 1974. 4 fig, 2 tab, 23 ref.

Descriptors: \*Weather modification, \*Thunderstorms, \*Convection, \*Clouds, Cloud seeding, On-site investigations, Heat, Velocity, Meteorology.

Identifiers: Ascending jets, Descending jets, USSR.

Cloud and precipitation formation initiated by ground heat sources (intensive fires), have been observed throughout history. In certain parts of South American and Equatorial Africa, rain was caused by deliberately lighting fires in prairies and savannah. The experiments conducted by Dessens in Equatorial Africa and in France allowed him to postulate certain meteorological conditions when success in inducing artificial precipitation could be expected. In the Soviet Union, a modification of the installation for generating artificial ascending jets was proposed which used aircraft turbojet engines instead of burners, thus generating a vertical jet of heated air with high initial velocity. An experimental set of 10 engines was developed which could generate power up to 500,000 kw. The presence of the jet favored more rapid cloud development and its 'connection' with a given place. The addition of a reagent might increase the efficiency. Since the 1930s and 1940s, a number of scientists have tried to stem convective cloud development by means of various reagents such as powder, sand, soot, etc. It was observed that when such substances were introduced at the top of a cloud, in a number of cases the cloud lowered, broke up into parts, or completely disappeared.

Results of texts of this method in the Soviet Union show that thunderclouds were destroyed in approximately 80% of cases; 70% in the case of frontal clouds. (See also W75-09944) (Sims-ISWS) W75-09973

#### RESULTS OF EXPERIMENTAL AND OPERATIONAL WORK ON COMBATING FOREST FIRES,

Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr, Leningrad (USSR).  
E. S. Artsybashev, P. A. Gubin, A. I. Sidorov, Ju. P. Suman, and N. S. Shishkin.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 265-266, 1974. 4 ref.

Descriptors: \*Weather modification, \*Forest fires, \*Cloud seeding, On-site investigations, Rainfall, Precipitation(Atmospheric), Artificial precipitation, Silver iodide, Nucleation, Meteorology.

Identifiers: USSR.

Studies of the possibility of rainfall redistribution in regions of forest fires were begun in 1968 at the Main Geophysical Observatory and the Forest Economy Institute of Leningrad. The extinguishing of forest fires by artificial precipitation is an example of practical application of weather transformation methods. Four air groups attempted to extinguish 280 forest fires in 1970-1972 by this new method. Seeding locations were chosen based on the speed and direction of movement of the clouds so that induced rainfall will occur over the fire some 10-15 minutes later. An ice-forming agent was introduced into the cloud with help of pyrotechnical cartridges of 26 mm caliber containing 16 g AgI or PbI<sub>2</sub>. Induced precipitation fell on 214 fires (77%), of which 121 fires (43%) were extinguished by it. Their total area was 177,000 hectares. Statistics on the areas of fires extinguished by induced precipitation compared with the areas where conventional firefighting methods were used permit the conclusion that extinguishing forest fires over an area of 120,000 hectares in 1970-1971 prevented their spreading and preserved the forest at the area of 220,000 hectares. Investigations are currently being pursued to improve this new method. (See also W75-09944) (Sims-ISWS) W75-09974

#### CONVECTIVE CLOUD MODIFICATION TO REDUCE THUNDERSTORM ACTIVITY,

Central Aerological Observatory, Moscow (USSR).  
I. I. Gaivoronsky, L. P. Zatsepina, and B. I. Zimin.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 267-274, 1974. 6 fig, 3 tab, 4 ref.

Descriptors: \*Weather modification, \*Thunderstorms, \*Lightning, \*Cloud seeding, Storms, Cloud physics, Precipitation(Atmospheric), Radar, Instrumentation, On-site investigations, Meteorology.

Identifiers: Lightning suppression, Chaff seeding, Corona discharge, Electric charge.

In summer 1972 a randomized modification experiment on thunderstorms was begun in Moldavia. Thunderstorm clouds with tops from 9 to 12 km were seeded by means of antihail rockets. Between 9 and 12 kg of PbI<sub>2</sub> was introduced into the cloud between isotherms -6 and -20°C. To assess the seeding results, lightning frequencies in 6 seeded clouds (before and after seeding) and 5 control clouds were compared. The mean lightning frequency in control clouds was 3.8 and in seeded

clouds before seeding was 4.0 discharges per minute. The lightning frequency was reduced in all cases after seeding. The average reduction was equal to a factor of 2.4-2.5 compared with the control clouds or the seeded clouds prior to seeding. On the same proving ground in Moldavia in 1972 the randomized modification experiment on convective clouds with the help of large antihail rockets carrying powders was begun. Experiments carried out earlier had confirmed the possibility of destroying convective clouds by including descending currents through roughly dispersed powders released into the upper region of a cloud from an aircraft. Results of these experiments confirmed the feasibility of the rocket method to regulate the evolution of convective clouds with a thickness equal to 4.7 km. (See also W75-09944) (Sims-ISWS) W75-09975

**ON THE POSSIBILITY OF THUNDERSTORM SUPPRESSION BY CHANGING THE NON-EQUILIBRIUM CRYSTALLIZATION POTENTIALS OF CLOUD WATER,**  
Vysokogornyi Geofizicheskii Institut, Nalchik (USSR).

For primary bibliographic entry see Field 2B.  
W75-09976

**SOME QUESTIONS OF THUNDERSTORM LIGHTNING CONTROL,**  
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).  
For primary bibliographic entry see Field 2B.  
W75-09977

#### THE EFFECT OF CHAFF SEEDING ON LIGHTNING AND ELECTRIC FIELDS OF THUNDERSTORMS,

National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.  
H. W. Kasevitz.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 289-294, 1974. 3 fig, 7 ref.

Descriptors: \*Weather modification, \*Thunderstorms, \*Lightning, \*Electrical coronas, Electricity, Cloud physics, Atmosphere, Atmospheric physics, Cloud seeding, On-site investigations, Meteorology, Electric fields.

Identifiers: \*Lightning suppression, Chaff seeding, Corona discharge, Electric charge.

Corona discharge appears at the ends of a chaff fiber in an electric field of 30 kv/m or more. If a pound of chaff consisting of about 2 million fibers is released from an airplane in a thunderstorm field of about 60 kv/m, a corona current of about 1 microampere is generated at the ends of each fiber. The net current of the 2 million fibers adds up to about 2 amperes and the charge released into the cloud in 100 seconds would be of the order of 200 coulomb. The net current and the net charge are comparable to the values of an average thunderstorm and will tend to neutralize the thunderstorm field. The application of this concept to modifying lightning or thunderstorm fields has two main difficulties: (1) the distribution of chaff fibers in the high field areas of the cloud must be fast enough to be effective in a large cloud volume, and (2) the possibility that ions liberated by corona discharge are trapped by the cloud droplets in the immediate neighborhood of the individual chaff fiber. This could generate a concentrated space charge around the fiber, which may quench the corona discharge before a large amount of charge is released. To investigate these problems, field experiments have been planned. After preliminary tests in Flagstaff, Arizona, the first of these experiments was carried out in

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Boulder, Colorado, in 1972. The results indicate that the decay of the electric field under a thunderstorm is accelerated by about a factor five by chaff seeding as compared with the natural decay of the field of a nonseeded storm. Instrument development, test procedures, data analysis, and the significance of this field decay experiment to lightning modification were discussed. (See also W75-09944) (Sims-ISWS) W75-09978

**THE POSSIBILITY OF USING CHARGED BUBBLES IN CLOUD MODIFICATION,**  
Institute of Experimental Meteorology, Obninsk (USSR).

For primary bibliographic entry see Field 2B.

W75-09979

**ON THE POSSIBILITY OF GENERATING DOWNDRAFFS BY INTRODUCING A HIGH CONCENTRATION OF COARSE AEROSOL PARTICLES IN THE ATMOSPHERE,**  
Vysokogornyi Geofizicheskiy Institut, Nalchik (USSR).

V. G. Khorguani, and Kh. M. Kalov.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 301-308, 1974. 4 fig, 3 tab, 5 ref.

Descriptors: \*Weather modification, \*Aerosols, \*Clouds, Laboratory tests, Laboratory equipment, Convection, Cloud seeding, Cloud physics, Atmospheric physics, Meteorology, Particle size, Particle shape.

Identifiers: Powder, \*Downdrafts, Cloud destruction.

Experiments on the destruction of convective clouds by a system of coarse aerosol particles were conducted. An initial impulse of downdraft velocity is generated by releasing a high concentration system of coarse aerosol particles at the top of a developing convective cloud. The descent velocities increase with increasing mass and reach several meters per second which is 1.5-2 orders of magnitude greater than the descent velocity of an isolated particle of the same material. In unstable conditions, the down-draft will be propagated after having been given the initial impulse and this will result in convective cloud destruction. Theoretical calculations and analysis of a great number of experiments together with the results of the experiments prove the possibility of using this technique for destroying convective clouds. (See also W75-09944) (Sims-ISWS) W75-09980

**THE EML 1973 FLORIDA AREA CUMULUS EXPERIMENT,**  
National Oceanic and Atmospheric Administration, Coral Gables, Fla. Experimental Meteorology Lab.

R. I. Sax, J. Simpson, and W. L. Woodley.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 309-316, 1974. 1 fig, 1 tab, 5 ref.

Descriptors: \*Weather modification, \*Artificial precipitation, \*Cloud seeding, Cloud physics, Clouds, Model studies, Rainfall, Radar, Precipitation(Atmospheric), Silver iodide, Nucleation, Convection, \*Florida, Meteorology.  
Identifiers: Tropical cumulus clouds.

The 1973 Florida Area Cumulus Experiment (FACE) of NOAA's Experimental Meteorology Laboratory (EML) is the latest in a ten-year series of statistically controlled experiments to evaluate the effects of dynamic seeding on tropical cumulus

clouds. Dynamic seeding of super-cooled convective clouds is based on the hypothesis that massive seeding with artificial ice nuclei can, under specific and predefinable conditions, cause enhanced cloud growth had lifetimes, leading to increased precipitation in some situations. The experiments began on isolated cumulus clouds and have been guided by a one-dimensional numerical simulation of precipitating cumulus towers. By 1969, it had been demonstrated that with 26 pairs of single-clouds, the radar-deduced total rainfall from the seeded cumuli was about a factor of three more than from the controls with a significance at the 5% level using several statistical tests. In 1970, EML progressed from single cloud experiments to cloud group seeding in a 10,000 sq km (later increased to 12,000 sq km) target area, to determine whether dynamic seeding could promote 'cumulus mergers' and possibly increase the net rainfall over a large area. Randomization in the area experiment was by day. Both 'floating' and total target rainfall were evaluated with calibrated S-band radars. At the present time, the best estimate of the 'floating target' rainfall increase is comparable to that for single clouds, (i.e., a factor of three) but only at the 10% significance level. (See also W75-09944) (Sims-ISWS) W75-09981

**TECHNICAL DEVICES FOR THE ARTIFICIAL MODIFICATION OF CLOUD AND FOG,**  
Central Aerological Observatory, Moscow (USSR).

I. I. Gaivoronsky, Yu. A. Seregin, A. I. Sidorov, and S. A. Silin.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 319-324, 1974.

Descriptors: \*Weather modification, \*Equipment, \*Cloud seeding, Artificial precipitation, Silver iodide, Carbon dioxide, Aerosols, Engineering, Precipitation(Atmospheric), Meteorology.

Identifiers: \*USSR, Airborne equipment, Ground-based equipment, Pyrotechnic devices, Rockets.

Investigations showed that seeding from an airplane into the upper surface of the cloud with dry ice in dust form was less effective than seeding with particles of 0.3-0.5 cm. Two types of equipment for disseminating CO<sub>2</sub> from aircraft were developed. One of these is based on the transformation of liquid CO<sub>2</sub> into solid onboard the aircraft itself. A device was developed which converts solid CO<sub>2</sub> from standard solid blocks into granules of between 0.2 and 1 cm, with a prevailing size of 0.3-0.6 cm and not more than 10% of dust. A list was made of the most effective pyrotechnic compounds for the volatilization of silver iodide and lead iodide. Suitable devices were designed for ensuring the steady and reliable burning of the pyrotechnics when fired at great heights from aircraft or from ground installations. A special aerosol container for dropping from aircraft, with a capacity of about 30 g of powder, was developed for seeding clouds with cuprous sulphide and other dusts. A rapidly developing aspect of the problem of weather modification is the stimulation of downdrafts in unstable air by the artificial generation of a downward movement by seeding the clouds with coarse-grained aerosol. A special remote-controlled installation was designed to ensure that, despite the high speed at which the aircraft is moving, the aerosol is released in a compact cloud and dispersed in the form of a trail. The series of ground-based and airborne devices for active intervention on clouds now render possible a wide range of experimental work. (See also W75-09944) (Sims-ISWS) W75-09982

**ENGINEERING AND OPERATIONAL ASPECTS OF WEATHER MODIFICATION,**  
South Dakota School of Mines and Technology, Rapid City, Inst. of Atmospheric Sciences.

A. S. Dennis, and R. A. Schleusener.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 325-332, 1974. 2 tab.

Descriptors: \*Weather modification, \*Rainfall, \*Hail, \*South Dakota, Cloud seeding, Silver iodide, Nucleation, Precipitation(Atmospheric), Artificial precipitation, Projects, Meteorology, Agriculture.

Identifiers: \*Seeding techniques, Hail suppression.

Various seeding concepts and delivery techniques were reviewed as a back-ground to the South Dakota cloud seeding program which was designed to increase rainfall and suppress hail. Because of the variety of crops grown in South Dakota and wide variations in crop and soil moisture conditions, it was decided that the program should be under local control. Each of the 67 county governments decides annually whether the county will participate in the program during the following year and also chooses the periods when seeding will be done. The decision that seeding would be concentrated on convective clouds, occurring either in isolation or in squall lines, led to the choice of updraft seeding from airborne generators as the delivery technique. Acetone generators carrying a solution of silver iodide and ammonium iodide in acetone were selected as the basic seeding technique. The program started in 1972 with a 4% solution by weight, but in 1973 a 2% solution was used. In hail suppression situations, the generators were supplemented by the burning for as short as 30 seconds of flares containing up to several hundred grams of silver iodide each. As this program was not randomized, some commonly used evaluation techniques are not applicable. Although there were a large number of hail threats resulting in deployment of aircraft for seeding, hail damage to crops through mid-August totaled approximately \$10,000,000, about one-third of the long-term average. Despite the lack of an accurate evaluation of the results obtained so far, the South Dakota program is regarded favorably by approximately 75% of the people in the state according to a survey in late 1972. (See also W75-09944) (Sims-ISWS) W75-09983

**ANTI-HAIL ROCKETS AND SHELLS,**  
Gidrometeorologicheskii Institut, Leningrad (USSR). High-Altitude Geophysics Inst.  
N. Sh. Bibilashvili, I. I. Gaivoronski, G. G. Godoraze, A. I. Kartsevadze, and R. N. Stankov.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 333-341, 1974. 5 fig, 2 tab, 5 ref.

Descriptors: \*Weather modification, \*Cloud seeding, \*Hail, \*Equipment, Silver iodide, Sodium chloride, Aerosols, Agriculture, Meteorology.  
Identifiers: \*USSR, \*Hail suppression, Rockets, Shells, Lead iodide, Pyrotechnical devices.

The first Soviet PGIM anti-hail rocket was developed in 1958-1959. The head of the PGIM rocket contains a cartridge of a pyrotechnical compound which is ignited by a remote-controlled mechanism at any desired point in the rocket's trajectory and, in burning, emits AgI or PbI<sub>2</sub> aerosols. With a view to increasing the height and radius of action of the reagent vector and the quantities of reagent carried into the clouds, and also to improve other aspects of hail control operations, the 'Oblako' anti-hail rocket was developed

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in 1961-1964. With the operational experience of the PGIM and 'Oblako' anti-hail rockets, a new anti-hail unit, the 'Alazan,' was developed in 1968-1970. Experimental work carried out in the northern Caucasus from 1961 to 1963 on the modification of hail-forming processes by the use of artillery shells with crystallizing reagents showed this to be an effective and economic method of protection from hail. The method, however, was unacceptable for security because the explosion of ordinary artillery shells produces large fragments which are dangerous if they fall on densely inhabited areas. The problem, therefore, was to develop a special type of shell. Research during 1962-1964 led to the development of the 'Elbrus-2' anti-hail shell. The body of the shell is of cast-iron and the base is spherical. The combination of a highly explosive charge with thin cast-iron walls and a number of other new design features ensured that the shell would be shattered into small, safe fragments. In order to increase the range, a 130-mm shell, the 'Elbrus-3,' was developed in 1966, retaining the essential characteristics of the 'Elbrus-2' shell. (See also W75-09944) (Sims-ISWS) W75-09984

#### RADAR METHODS AND EQUIPMENT FOR HAIL SUPPRESSION,

Gidrometeorologicheskii Institut, Leningrad (USSR). High-Altitude Geophysics Inst.

M. T. Abshaev, and A. I. Kartsivadze.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 343-351, 1974. 5 fig, 12 ref.

Descriptors: \*Weather modification, \*Hail, \*Cloud seeding, \*Radar, Equipment, Data collections, Data processing, Storms, Meteorology, Engineering.

Identifiers: \*USSR, \*Hail suppression, Dual-wavelength radar, Hail detection.

The plan of action for cloud seeding is determined by the stage of its development, by the scale and the nature of the hail-forming process, and by the direction and speed of movement. A successful intervention depends on a rapid identification of clouds already containing hail and those potentially capable of producing it. It appears that for 95% accuracy in distinguishing between hail clouds and non-hail clouds, measurements of three parameters are adequate; these are the maximum radar reflectivity, the temperature at the radar-echo upper boundary level, and temperature at the level of the increased reflectivity zone. Employment of doppler equipment enables hail detection in a very simple and effective way, but using the width or mean square width of the doppler frequency spectrum. Considerably more useful information is provided by a dual technique of hail detection. This technique is based on the different radio-wave scattering properties of hydrometeors of different sizes. A high-potential, specialized radar for hail suppression and storm warning was devised. This is a dual-radar station 'Radiograd.' The antenna unit provides equal widths (1.5 degrees) and matching of the radiation patterns for both wave-bands with high accuracy. Further improvements are still necessary in hail identification methods to increase efficiency and achieve complete automation in obtaining and presenting information. (See also W75-09944) (Sims-ISWS) W75-09985

#### THE ACQUISITION OF INFORMATION DURING ATTEMPTS AT WEATHER MODIFICATION,

Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.

For primary bibliographic entry see Field 7B.

W75-09986

#### PRELIMINARY RESULTS OF EXPERIMENTS USING SEEDING ROCKETS WITH COMBUSTIBLE SHELLS,

National Research Center for Disaster Prevention, Tokyo (Japan).

Y. Ozawa, and Y. Omoto.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 363-371, 1974. 5 fig, 3 tab.

Descriptors: \*Weather modification, \*Cloud seeding, \*Hail, \*Equipment, Nucleation, Silver iodide, Artificial precipitation, Precipitation (Atmospheric), Meteorology, Engineering.

Identifiers: \*Japan, \*Rockets, Hail suppression, Pyrotechnic devices.

A 5-year hail suppression research project in Japan ended in 1972. A rocket system was used for seeding. It was shown that dispersion of artificial nuclei with high concentration into the appropriate part of hail producing clouds is the most effective method of hail suppression. Since it was not possible to use aircraft or anti-aircraft guns for the experiment, a method using rockets launched from the ground was chosen. Disintegration of seeding rockets by using explosive compounds had been used for hail suppression experiments in all foreign projects known of at the time. However, it was recognized that such a system over public land would be extremely difficult in Japan. Consequently, a method was developed by which the rocket body would completely burn away in the air after seeding. After 2 years of development, the NRCDP-1 rocket was completed. The NRCDP-1 rocket exhibited generally satisfactory performance in regard to flight, dissipation, and seeding. However, it is desirable to carry out more seeding experiments with a larger number of rockets in order to obtain more data concerning seeding effects, especially in the case of convective clouds. For this purpose, however, some improvement of the rocket system is desirable. (See also W75-09944) (Sims-ISWS) W75-09990

#### CONVECTIVE CLOUD STUDY RESULTS APPLIED TO WEATHER MODIFICATION,

Sredneaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tashkent (USSR).

For primary bibliographic entry see Field 2B.

W75-09988

#### ON THE THERMODYNAMIC CRITERIA FOR THE INTENSITY OF CONVECTIVE CLOUD DEVELOPMENT,

Bulgarian Hydrometeorological Service, Sofia.

For primary bibliographic entry see Field 2B.

W75-09989

#### A REVIEW OF METHODS TO EVALUATE PRECIPITATION MODIFICATION IN NORTH AMERICA,

Illinois State Water Survey, Urbana. Atmospheric Sciences Section.

S. A. Changnon, Jr.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 397-422, 1974. 4 fig, 7 tab, 20 ref. Dept. of Int. Contract 14-06-D-7197 NSF Grants GI-33371, GI-38317, GK-37859.

Descriptors: \*Weather modification, \*Evaluation, \*Methodology, \*North America, Cloud seeding, Projects, Rainfall, Snowfall, Hail, On-site data collections, Model studies, Stochastic processes, Statistical methods, Variability, Sampling, Meteorology, Reviews.

Identifiers: Randomization, Target-control methods, Cross-over methods, Continuous-historical methods.

The history of evaluation methods used in weather modification was reviewed. Selected examples of the natural variability of rain and hail were described and it was shown how variability complicated evaluation of rain and hail modification. Various evaluation methods were discussed that have been used in rainfall, snowfall, and hail modification projects. Means of collecting surface data to evaluate rain and hail experiments were evaluated and their limitations and values were indicated. It was concluded that the many North American projects, both commercial and government supported, of the last 25 years have provided a wealth of conflicting results attributable to a variety of causes, and have often employed inadequate and confusing evaluation methodologies. (See also W75-09944) (Sims-ISWS) W75-09990

#### METHODS OF ESTIMATING PHYSICAL AND ECONOMIC EFFECTIVENESS OF WEATHER MODIFICATION,

Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).

M. V. Bujkov, and E. E. Kornienko.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 423-430, 1974. 3 tab, 2 ref.

Descriptors: \*Weather modification, \*Evaluation, \*Artificial precipitation, \*Hail, Cloud seeding, Economics, Benefits, Precipitation (Atmospheric), Model studies, Cloud physics, Nucleation, Meteorology.

Identifiers: \*USSR, Hail suppression.

The numerical simulation of clouds may help control the results of weather modification experiments; but in order to exclude atmospheric turbulence, it is necessary to make calculations with the space increments equal to 0.1 cm and the time increments equal to 0.1 sec. Information about the physical processes in clouds may make easier the classification of natural situations, permit selection of more homogeneous samples, produce statistically significant results with smaller numbers of experimental units, and give qualitative evidence of the artificial changes of cloud state. Four long-duration experiments on precipitation augmentation were carried out in the USSR. The results of these experiments were re-evaluated with consideration given to the economic effectiveness of the experiments. The value of the additional crops produced because of the precipitation increase and the expenses to carry out the cloud seeding were considered. Calculations taken into account only one crop and the cloud seeding during two arbitrarily chosen vegetation periods. A formula was derived for the direct estimation of the profit and the profit rate and may be used for the optimal design of a cloud-seeding experiment. A review was made of the methods of evaluation applied in the antihail operations in the USSR. These methods do not take into account that after inspection of hail damage, farm workers may compensate for some of the damage by devoting additional work. A very disappointing shortcoming of the methods reviewed was the complete lack of statistical evaluation of the results of antihail operations. (See also W75-09944) (Sims-ISWS) W75-09991

#### ECONOMIC ASPECTS OF PRECIPITATION AUGMENTATION OVER THE GREAT LAKES,

Illinois State Water Survey, Urbana.

For primary bibliographic entry see Field 6B.

W75-09992

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3B—Water Yield Improvement

#### AN EVALUATION OF EXTENDED AREA EFFECTS FROM ATTEMPTS TO MODIFY LOCAL CLOUDS AND CLOUD SYSTEMS, Colorado State Univ., Fort Collins.

G. W. Brier, L. O. Grant, and P. W. Mielke, Jr.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 439-447, 1974. 6 fig, 12 ref. NSF Grant GI-31460.

Descriptors: \*Weather modification, Effects, \*Cloud seeding, \*Artificial precipitation, Rainfall, Clouds, Precipitation(Atmospheric), Nucleation, Cloud physics, Statistical methods, Meteorology, \*Evaluation.

Identifiers: \*Extended area effects, Downwind effects.

Weather modification programs involving the release of seeding material for augmenting precipitation or for reducing storm damage are in progress in the United States and other countries. There is increasing evidence that the effects of some of these experiments or operations may extend over a considerably broader geographic area than that for which they are intended. Although the evidence is not conclusive, a number of questions have caused an increasing concern among both scientists and administrators. Initially, the concern about extended area effects was limited to speculations about the possibility of adverse 'rainshadow' effects in areas downwind of precipitation augmentation projects. However, preliminary analyses by several investigators suggested that positive rather than negative anomalies had occurred downwind of the intended target in a number of projects. Several processes, or mechanisms, may reasonably produce such effects. These include processes that primarily involve (1) atmospheric transport followed by microphysical effects, (2) dynamic effects, and (3) transport processes combined with dynamic effects. The research in progress at Colorado State University on the reality and processes of downwind effects from cloud seeding activities was described. Recent analyses indicate that increases in the target area were not at the expense of downwind precipitation. The likelihood that the precipitation in the extended area was enhanced as a result of the seeding is high, but not conclusive. (See also W75-09944) (Sims-ISWS)  
W75-09995

#### RAIN STIMULATION EXPERIMENTS: DESIGN AND EVALUATION, California Univ., Berkeley. Statistical Lab.

For primary bibliographic entry see Field 7C.

W75-09994

#### ON PHYSICAL AND ECONOMIC EFFECTIVENESS OF HAIL-SUPPRESSION PROJECTS, Institute of Experimental Meteorology, Obninsk (USSR).

L. P. Poluektova, and V. V. Tsukunov.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR), WMO No 399, Geneva (Switzerland), p 459-464, 1974. 1 tab, 8 ref.

Descriptors: \*Weather modification, \*Hail, \*Economics, \*Evaluation, Cloud seeding, Statistical methods, Benefits, Precipitation(Atmospheric), Correlation analysis, Meteorology.

Identifiers: \*USSR, \*Target-control evaluation, Hail suppression.

While analyzing antihail activities, it is necessary to conceive all possible after-effects, both expected and accidental, to determine if they are due to weather modification or to some other factors.

and to evaluate the accuracy of the estimates made. It is important to consider two effects: (1) the physical effect of hail-suppression efforts irrespective of the expenses made and crops protected, (2) the economic effect of hail-suppression projects when crops, progress in hail modification, and all the expenses are considered. Modification effect estimation from the reduction of the equivalent crop hail damage area is more objective than the absolute crop hail damage area; although these are not physical efficiency estimations because they indirectly depend on the protected object parameters, the total crop areas, and the crops used. To test the calculation accuracy of the relative economic efficiency by the target-control approach, a statistical experiment was staged. The target-control approach is characterized by a large estimation error in economic efficiency. Precise definition of suppressed hailfall parameters decreases the error approximately up to 25%. The accuracy might be even higher if the suppressed hailfalls could have been localized. (See also W75-09944) (Sims-ISWS)  
W75-09995

#### RADAR CHARACTERISTICS OF CUMULONIMBUS CLOUDS DURING THEIR NATURAL DEVELOPMENT AND ARTIFICIAL SEEDING, Akademiya Nauk Gruzinskoi SSR, Tiflis. Institut Geofiziki.

For primary bibliographic entry see Field 2B.

W75-09996

#### ON THE CHARACTERISTICS OF SINGLE-CELL SHOWERS, Iowa State Univ., Ames.

For primary bibliographic entry see Field 2B.

W75-09997

#### PREPARATION AND PROPERTIES OF 'PURE' SILVER IODIDE AEROSOL, Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire de Meteorologie Dynamique.

M. M. Poc, and M. Rouleau.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR), WMO No 399, Geneva (Switzerland), p 485-498, 1974. 9 fig, 5 ref.

Descriptors: \*Silver iodide, \*Aerosols, \*Laboratory equipment, \*Nucleation, Ice, Chemistry, Laboratory tests, Methodology, Equipment, Cloud seeding, Weather modification.

Identifiers: \*Ice nuclei.

Although silver iodide has been used for many years in weather modification experiments, the basic mechanisms by which it acts as an ice nucleant are not well known. It appears clearly from literature that the nucleating ability of silver iodide is strongly dependent on the manner in which it is prepared. To understand the nucleation processes, superficial modifications of AgI crystals, such as presence of impurities, water absorption, reactions with surrounding atmosphere, etc., must be avoided. The best way to prepare pure silver iodide is to make iodine vapor react on a silver aerosol in an inert dry atmosphere and in darkness. Procedures and equipment were described for the preparation of a monodispersed aerosol of pure silver iodide which has the following properties: (1) particles per cu cm are 5,000,000, (2) average diameter is 20 angstroms, (3) threshold activity temperature as freezing nucleus is 2.5 times 10 to the 14th power active nuclei per gram AgI at -20°C. These results for size distribution and freezing activity show reasonable agreement with Fletcher's theory. It is difficult to compare this work with other author's results because it is the first time that particles with such a small size were studied as ice nuclei. This pure

silver iodide aerosol may be useful for further studies on the influence of various factors on nucleation mechanisms. (See also W75-09944) (Sims-ISWS)  
W75-09998

#### AN ICE NUCLEI CONCENTRATION BENCHMARK NETWORK, National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

For primary bibliographic entry see Field 7A.  
W75-09999

#### REMOVAL OF PYROTECHNIC GENERATED TRACER PLACED BY AIRCRAFT IN A CONVECTIVE UPDRAFT, Michigan Univ., Ann Arbor.

A. N. Dingle.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR), WMO No 399, Geneva (Switzerland), p 507-520, 1974. 8 fig, 5 ref.

Descriptors: \*Tracers, \*Convection, \*Thunderstorms, \*Weather modification, \*Illinois, Cloud seeding, Nucleation, Aircraft, Sampling, Distribution patterns, Rain water, Storms, Precipitation(Atmospheric), Cloud physics, Meteorology.

Identifiers: \*Pyrotechnic devices, Indium, Ice nuclei.

A field experiment, based on the indium tracer technique and the silver iodide seeding of convective systems by airborne pyrotechnic flares, was conducted in central Illinois on 1 June 1970 and yielded a comprehensive pattern of indium deposition. Study of the indium deposition pattern shows that material placed nominally in a convective updraft above and ahead of a cold frontal zone may be transported in considerable quantities into the region below and behind that zone. The obvious transport mechanism is found in the downdrafts which are necessarily interspersed with the updrafts throughout the sub-cloud adiabatic layer. It was concluded that somewhat less than 17% of the silver iodide, generated and placed similarly for convective cloud modification, penetrates intact to the cloud regions where it can nucleate the ice phase by contact with super cooled water droplets. This fraction of seeding agent is most likely to fall in a size range averaging somewhat less than 0.1 micrometer in radius. It was therefore implied that silver iodide seeding via convective updrafts may be improved in efficiency by limiting the size of the silver iodide particles to the range from 0.05 to 0.1 micrometer as they are generated. (See also W75-09944) (Sims-ISWS)  
W75-10000

#### ICE NUCLEI GENERATOR TECHNOLOGY, Denver Research Inst., Colo.

N. Fukuta.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR), WMO No 399, Geneva (Switzerland), p 521-529, 1974. 2 fig, 15 ref.

Descriptors: \*Weather modification, \*Cloud seeding, \*Nucleation, Crystals, Silver iodide, Carbon dioxide, Toxicity, Engineering, Cloud physics, Clouds, Precipitation(Atmospheric), Atmospheric physics, Meteorology.

Identifiers: \*Ice nuclei, Ice nuclei generators, Dry ice, Nucleants.

Discussed were problems related to the ice-nuclei generation technique, their characteristics, and their usage within the reacting cloud system. There are two methods of particle generation, i.e., the

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Domestic and Municipal Use—Group 3D

dispersion and condensation methods. Experimental and theoretical studies of ice-forming nuclei indicate that the optimum size for cloud seeding is around 0.1 micron in radius or slightly less. The best method of submicron particle production is that of condensation. The control of nucleant particle size is probably the most important problem for seeding generator development. The nuclei particles generated are subject to deactivation. Coagulation is also important during the process of smoke generation. Small ice crystals formed by seeding of coolants disappear when they experience temperatures higher than 0°C. The ice crystal growth rate by diffusion, at a given time after nucleation, shows two maxima with respect to temperature, at -6.5 and at -18°C. For effective seeding, it is desirable for the cloud parcel to maintain upward motion so that the ice crystal growth continues. The results of seeding experiments are dependent on the particular nuclei compound used. An advantageous feature of a particular nucleant for one condition can often become a drawback for another. The best approach appears to develop several different kinds of nucleants, each having advantageous features in its own area. By knowing the nucleants features in nucleation, by understanding their interactions in cloud processes, and by making use of computer modeling, optimum use of the seeding material may be sought. (See also W75-09944) (Sims-ISWS)

W75-10001

#### CLOUD GLACIATION BY LIQUEFIED PROPANE SPRAY,

Cold Regions Research and Engineering Lab., Hanover, N.H.

J. R. Hicks, and G. Vali.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR), WMO No 399, Geneva (Switzerland), p 531-538, 1974. 5 fig, 2 tab, 16 ref. Dept. of Int. Contract 14-06-D-6801.

Descriptors: \*Weather modification, \*Propane, \*Glaciation, Crystals, Ice, Cloud physics, Laboratory tests, On-site investigations, Nucleation, Cloud seeding, Fog, Clouds, Meteorology. Identifiers: \*Liquefied propane.

Laboratory tests at various temperatures but with constant cloud densities yielded ice crystal production efficiencies between 2 times 10 to the 11th power and 6 times 10 to the 11th power crystals per gram of propane. The efficiency decreases rapidly above -2°C but is still 10 to the 10th power crystals per gram within a few tenths of a degree below 0°C. The results of the field tests with the 0.5-mm solid stream nozzle showed more variability, the nucleating efficiency varying between 10 to the 11th power and 5 times 10 to the 12th power crystals per gram in apparent response to the combined effects of cloud density and wind velocity. Since these factors influence the rate of vapor supply of the seeded plume, this rate appears to be a limiting factor for the numbers of crystals being produced. On the whole, the agreement between laboratory and field tests was satisfactory so that the extension of the field results, on the basis of the laboratory tests, to temperatures not covered in the field tests appears to be justified. The shapes of ice crystals produced and their growth rates indicate that the vapor pressure within the plume was frequently depressed below water saturation. These observations further confirm the critical role of vapor supply in determining the seeding effect both in terms of the numbers of crystals produced and the size reached by the crystals over a given path of length. The experiments described confirmed the possible utility of liquefied propane as a cloud-seeding agent. (See also W75-09944) (Sims-ISWS)

W75-10002

#### SUMMARY OF OBSERVATIONS INDICATING DYNAMIC EFFECT ON SALT SEEDING IN WARM CUMULUS CLOUDS,

Institute of Tropical Meteorology, Poona (India). A. S. Ramachandra Murty, A. M. Selvam, and Bh. V. Rama Murty. Journal of Applied Meteorology, Vol 14, No 4, p 629-637, June 1975. 6 fig, 2 tab, 6 ref.

Descriptors: \*Cloud seeding, \*Weather modification, \*Sodium chloride, \*Clouds, Salts, On-site investigations, Cloud physics, Atmosphere, Precipitation(Atmospheric), Meteorology.

Identifiers: \*Cloud dynamics, Cumulus clouds, Liquid water content.

Measurements of cloud liquid water content and temperature were made along with visual observations in 32 traverses carried out in six warm cumulus clouds subjected to salt seeding. The results showed (1) a rise, of 1-2°C, in temperature; (2) an increase, sometimes exceeding 200%, in liquid water content; and (3) vertical growth, up to 60%, in seeded clouds which developed rain. The features could be due to the possible dynamic effect of salt seeding in warm clouds. (Sims-ISWS)

W75-10057

#### WATER DEVELOPMENT FOR IRRIGATION IN NORTHWESTERN KANSAS,

Geological Survey, Lawrence, Kans.

For primary bibliographic entry see Field 4B.

W75-10152

#### INITIAL STAGE, GARRISON DIVERSION UNIT, PICK-SLOAN MISSOURI BASIN PROGRAM, NORTH DAKOTA (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Billings, Mont. Upper Missouri Region.

For primary bibliographic entry see Field 8A.

W75-10296

#### CLAYTON LAKE, JACK FORK CREEK, OKLAHOMA (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Tulsa, Okla.

For primary bibliographic entry see Field 8A.

W75-10297

#### AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH APPENDIX A (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Washington, D.C.

For primary bibliographic entry see Field 8A.

W75-10331

#### 3C. Use Of Water Of Impaired Quality

##### FAUNAL RESPONSE TO SPRAY IRRIGATION OF CHLORINATED SEWAGE EFFLUENT,

Pennsylvania State Univ., University Park. School of Forest Resources.

For primary bibliographic entry see Field 5D.

W75-09899

##### MANAGEMENT PRACTICES AFFECTING QUALITY AND QUANTITY OF IRRIGATION RETURN FLOW,

Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.

For primary bibliographic entry see Field 5G.

W75-10019

##### WATER AND WATER PROBLEMS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND SOME POSSIBLE SOLUTIONS,

Southwest Florida Water Management District, Brooksville.

G. G. Parker.

Water Resources Bulletin, Vol 11, No 1, p 1-20, February 1975. 9 fig, 16 ref.

Descriptors: \*Water management(Applied), \*Planning, \*Water supply, \*Florida, Water quality control, Water distribution(Applied), Water utilization, Legislation.

It is estimated that by about 1984 water demand in the District will nearly equal the natural average annual replenishment of the supply and that, thereafter, unless means are developed to augment the in-District resources, water mining will be required on a grand scale. Sources of augmentation include: reduction of wastes; industrial recycling of previously-used water; use of municipal sewage effluents; desalination of brackish groundwater; aquifer recharge from all available, high-quality sources, particularly flood waters; and importation of excess water from such out-of-District sources as the lower courses of the Suwannee and Apalachicola Rivers. To achieve maximum beneficial uses of in-District sources, a regional water and sewer authority is needed that can develop and transmit water from all available sources to the various county and city systems on a wholesale basis. It is envisioned that such a supply system would tie together all production sources, much as the electrical generation and supply systems are currently organized into regional electric power hookups. At least two bills are currently before the Florida Legislature to achieve these goals. (Bell-Cornell)

W75-10207

#### RECYCLE SLUDGE TO FEED FARMS,

CH2M/Hill, Denver, Colo.

For primary bibliographic entry see Field 5D.

W75-10282

#### 3D. Conservation In Domestic and Municipal Use

##### METHODS TO FACILITATE MANAGERIAL EFFECTIVENESS IN MUNICIPAL WATER SYSTEMS,

Mississippi State Univ., Mississippi State. Bureau of Business and Economic Research.

For primary bibliographic entry see Field 6B.

W75-09895

##### AN ANALYSIS OF RUNOFF IN AN URBAN AREA (IN JAPANESE),

For primary bibliographic entry see Field 5D.

W75-09916

##### HYDROLOGIC IMPACT OF PLANNED UNIT DEVELOPMENTS,

Maryland Univ., College Park. Dept. of Civil Engineering.

For primary bibliographic entry see Field 4C.

W75-09919

##### PROCEEDINGS OF WORKSHOP CONFERENCE ON IDENTIFICATION OF METROPOLITAN AREA WATER RESOURCES PROBLEMS AND ASSOCIATED RESEARCH NEEDS IN MINNESOTA.

Minnesota Univ., St. Paul. Water Resources Research Center.

For primary bibliographic entry see Field 6B.

W75-10004

##### CLIMATE OF MINNESOTA - PART VII - AREAL DISTRIBUTION AND PROBABILITIES OF PRECIPITATION IN THE MINNEAPOLIS-ST. PAUL METROPOLITAN AREA,

Minnesota Agricultural Experiment Station, St. Paul.

For primary bibliographic entry see Field 2B.

W75-10009

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3D—Conservation In Domestic and Municipal Use

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1973.**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10148

**TOTAL APPROACH FOR THE BOGOTA, COLUMBIA, WATER SUPPLY,**  
Empresa de Aqueuducto y Alcantarillado, Bogota (Colombia).  
J. Gonzalez, and M. S. Clark, III.  
Journal of the American Water Works Association, Vol 67, No 6, p 327-331, June 1975. 5 fig, 3 ref.

Descriptors: \*Water supply development, \*Systems analysis, \*Planning, Optimization, Simulation analysis, Linear programming, Dynamic programming, Computer programs, Irrigation, \*Municipal water, Hydroelectric power, Decision making, Hydrology, Tunnels, Economics, Operations research, Screening, Alternative planning. Identifiers: Cost minimization, Operating rules.

Water-related problems associated with rapid population growth in Bogota, Columbia have been the subject of a recent comprehensive engineering study. Summarizes are presented of the system-analysis portion of the study related to water resources development planning. The application of simulation, linear programming, and dynamic programming was instrumental in a multidisciplinary approach for selecting a minimum cost plan for municipal water supply, irrigation, and hydroelectric developments. Computer programs and systems analysis techniques were necessary in handling voluminous data and complex problems for six major activities: (1) development of monthly flow records; (2) analysis of daily flow records; (3) comparison of subsystems of diversion tunnels; (4) preliminary screening; (5) sensitivity analysis; and (6) simulation of alternative systems. For selected tunnel configurations, a minimum-cost solution and economical scale of development were obtained by dynamic programming. Linear programming was employed in preliminary screening and to examine the economic aspects of system operation and water-use allocation. Simulation related the studies of hydrology and tunnel-diversion subsystems. It identified maximum supply rates and searched for least-cost component capacities and operating rules. The general procedure for system operation was divided into four considerations: reservoir operation; irrigation; water supply; and power. Satisfactory solutions to real-world planning problems were found. (Bell-Cornell)  
W75-10203

**STATISTICAL ANALYSIS OF OPERATIONAL PERFORMANCE OF SOME PACKAGE PLANTS.**  
Department of Water Affairs, Pretoria (South Africa).  
For primary bibliographic entry see Field 5D.  
W75-10256

**PLANNING AND OPERATION OF URBAN WATER QUALITY MANAGEMENT SYSTEMS,**  
Cornell Univ., Ithaca, N.Y.  
For primary bibliographic entry see Field 5G.  
W75-10262

**SURFACE WATERS AND THE CIVIL LAW RULE,**  
Long and Aldridge, Atlanta, Ga.  
For primary bibliographic entry see Field 6E.  
W75-10304

**SIERRA CLUB V. LYNN (ACTION FOR DECLARATORY AND INJUNCTIVE RELIEF**

**WITH RESPECT TO DEVELOPMENT OF NEW HOUSING DEVELOPMENT).**  
For primary bibliographic entry see Field 6G.  
W75-10309

### 3E. Conservation In Industry

**ELECTROLYTIC DECOMPOSITION OF WATER,**  
Westinghouse Electric Corp., Pittsburgh, Pa. (assignee)  
L. E. Brecher, and C. K. Wu.  
US Patent No 3,888,750, 3 p, 10 fig, 12 tab, 2 ref; Official Gazette of the United States Patent Office, Vol 935, No 2, p 721, June 10, 1975.

Descriptors: \*Patents, \*Electrolysis, Electrolytes, Ionization, Oxidation, \*Chemical reactions, \*Separation techniques, Hydrogen, Oxygen. Identifiers: Water decomposition, Thermochemistry, Hydrogen production.

Electrolysis and catalytic thermochemistry are combined to decompose water. The object of the invention is to produce hydrogen for coal conversion into hydrocarbons and other purposes by decomposition of water at a minimum cost in energy. The electrolyte is H<sub>2</sub>S<sub>0</sub>3 produced by supplying S<sub>0</sub>2 and the water to be decomposed to the electrolyzer. The H<sub>2</sub>S<sub>0</sub>3 is ionized and oxidized in the electrolyzer into S<sub>04</sub><sup>-</sup> and H<sub>+</sub> ions and electrons. Hydrogen is derived from the negative electrode of the electrolyzer. The S<sub>04</sub><sup>-</sup> is combined with H<sub>+</sub> to form H<sub>2</sub>S<sub>04</sub>. The H<sub>2</sub>S<sub>04</sub> is removed from the electrolyzer to the thermochemical unit, concentrated and decomposed predominately into H<sub>2</sub>O, S<sub>0</sub>2 and O<sub>2</sub>. The S<sub>0</sub>2 is liquefied and thus separated from the O<sub>2</sub> which is derived from the thermochemical apparatus. The liquid S<sub>0</sub>2 is vaporized and returned to the electrolyzer. (Sinha-OEIS)  
W75-09881

**REVIEW OF THE CANADIAN METAL FINISHING INDUSTRY: CONSUMPTION OF RAW MATERIALS AND OPTIONS FOR WATER POLLUTION CONTROL.**  
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate. For primary bibliographic entry see Field 5D.  
W75-09926

**POLLUTION ABATEMENT IN THE PHARMACEUTICAL INDUSTRY,**  
National Environmental Research Center, Edison, N.J. Industrial Waste Treatment Research Lab. For primary bibliographic entry see Field 5D.  
W75-09931

**RECOVERING ORGANIC MATERIALS FROM WASTEWATER,**  
Rohm and Haas Co., Philadelphia, Pa.  
For primary bibliographic entry see Field 5D.  
W75-09932

**MEMBRANE PROCESSING IN THE METAL FINISHING INDUSTRY,**  
Abcor, Inc., Cambridge, Mass. Walden Research Div.  
For primary bibliographic entry see Field 5D.  
W75-09936

**ACTIVATED CARBON TREATMENT OF UNBLEACHED KRAFT EFFLUENT FOR REUSE,**  
Saint Regis Paper Co., Pensacola, Fla. Research and Development Center.  
For primary bibliographic entry see Field 5D.  
W75-10028

**A THEORETICAL AND EMPIRICAL APPROACH TO FISHERIES ECONOMICS,**  
Victoria Univ. of Manchester (England). Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 6C.  
W75-10118

### ARTIFICIAL REEFS FOR TEXAS.

Texas A and M Univ., College Station. Industrial Economics Research Div.  
Available from the National Technical Information Service, Springfield, Va 22161 as COM-74-10853, \$3.75 in paper copy, \$2.25 in microfiche. Sea Grant Program Report TAMU-SG-73-214 (IAC (72-73-1225), March 1974. 39 p, 11 fig.

Descriptors: \*Fishes, \*Reefs, \*Texas, Fish management, Financing, Legal aspects, Commercial fishing, Sport fishing, Habitats, Sites, Materials, Costs, Gulf of Mexico, Buoys. Identifiers: \*Artificial salt water reefs.

There is a lack of natural or accidentally created reefs to satisfy the increasing demand for sport and commercial fishing in Texas thus the construction of artificial reefs is investigated. The function of an artificial reef is to provide shelter for fish and to allow marine organisms to attach themselves, thus providing food for fish and establishing a food chain. Reef material suitability should be judged on availability, costs, durability in salt water and environmental impact. Usage of rubber tires, concrete pipes and blocks, automobile bodies, ships and barges, offshore oil platforms and other materials is evaluated. Proposed utilization of World War II Liberty Ships as reef material is discussed. The determination of site locations for man-made reefs must include many factors among them are: (1) avoidance of shipping fairways; (2) knowledge of existing bottom obstructions, depth, and seabed characteristics; and (3) availability of site to potential users. Total costs of a reef include materials, preparation, handling, sinking, marking and policing. Project financing is potentially available from state and national governmental agencies and from special interest groups, who often contribute materials, labor, and funds. Legal ramifications of submerged construction are discussed in terms of liability, public access, common law, navigation, conflicting uses, jurisdiction, and international law. (Becker-Wisconsin)  
W75-10119

**PRIMARY ECONOMIC IMPACT OF THE GULF INTRACOASTAL WATERWAY IN TEXAS,**  
Texas Engineering Experiment Station, College Station.  
For primary bibliographic entry see Field 6B.  
W75-10120

**GEOGRAPHICAL ANALYSIS OF OIL SPILL POTENTIAL ASSOCIATED WITH ALASKAN OIL PRODUCTION AND TRANSPORTATION SYSTEMS,**  
Battelle-Pacific Northwest Labs., Richland, Wash.  
For primary bibliographic entry see Field 5G.  
W75-10121

**THE COMPARISON OF THE ENVIRONMENTAL ASPECTS OF NUCLEAR AND FOSSIL FUELLED POWER STATIONS,**  
New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.  
For primary bibliographic entry see Field 8C.  
W75-10349

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Agriculture—Group 3F

#### 3F. Conservation In Agriculture

**EFFECTS OF IRRIGATION AND ROW SPACING ON EVAPOTRANSPIRATION AND MICROCLIMATE OF A SORGHUM FIELD,** Kansas State Univ., Manhattan Evapotranspiration Lab.

For primary bibliographic entry see Field 2D.

W75-09853

**PREDICTING EVAPOTRANSPIRATION FROM AGRICULTURAL WATERSHEDS UNDER DRY CONDITIONS,** Kansas State Univ., Manhattan. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2D.

W75-09860

#### IRRIGATION DEVICE,

G. Gilead.

US Patent No 3,887,138, 4 p, 6 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 196, June 3, 1975.

Descriptors: \*Patents, \*Irrigation, \*Irrigation operation and maintenance, \*Irrigation design, Water utilization.

Identifiers: \*Trickle irrigation.

A trickle or drip irrigation device comprises two hose like elements inserted into one another. One of the elements is helically grooved hose of conventional design. The inner member is held tightly in the outer element. Openings are provided in the inner element and an outflow or outflows at desired intervals are provided from the outer element. In other embodiments the inner member is an ungrooved hose or both the inner and the outer elements are helically grooved. In all cases a helical path is formed between the outer and inner elements. An assembly of the inner and outer element provided with openings can be manufactured in endless lengths and can be used as a water conduit with the water trickling from the outflow openings in the outer member. (Sinha-OEIS)

W75-09872

**TRICKLE IRRIGATION Emitter,** Illinois Tool Works Ltd., Slough (England). (assignee)

D. N. Pearce.

US Patent No 3,887,139, 3 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 196, June 3, 1975.

Descriptors: \*Patents, \*Irrigation, Irrigation operation and maintenance, Irrigation design, Equipment.

Identifiers: \*Trickle irrigation.

This invention concerns irrigation, particularly drip feed irrigation emitters of the kind in which water is fed through a narrow passageway which presents a marked frictional resistance to the water flow and thereby reduced that flow to no more than a trickle. The emitter for a trickle irrigation system is comprised of a housing defining a chamber which is closed except for inlet and outlet ports. The chamber contains a substantial length of fine diameter tubing which connects to only of the ports. The tubing is arranged for most of its length as spiral coil, the radially inner end of which is connected to the inlet port. The housing is preferably formed in two parts which can releasably fasten together. Each of the parts is a one-piece plastic moulding, and one of the parts is formed with a wall which partially defines a reservoir for water in which the outlet port can remain continuously submerged. (Sinha-OEIS)

W75-09873

**EFFECT OF WATER TABLE DEPTH ON YIELD OF CABBAGE, SQUASH AND TENDERGREEN,** Agricultural Research Service, Raleigh, N.C.

R. E. Williamson, and T. N. Gray.  
J Am Soc Hortic Sci. Vol 98, No 2, p 207-209, 1973.

Identifiers: Brassica-oleracea-var-capitata, Brassica-perviridis, \*Cabbage, Cucurbita-pepo, Squash, Tendergreen, \*Crop production, \*Water table depth.

Cabbage, Brassica oleracea var. capitata L., squash Cucurbita pepo Alef. and tendergreen, Brassica perviridis Bailey, were grown at various water table depths in sheltered soil tanks on a fine sandy loam and a loam soil to evaluate the effects of high water table and soil type on growth and yield of these vegetable crops. Yields of the 3 species increased with water table depth to a depth of 76-102 cm. On both soil types the 15-cm water table depth caused considerable yield reduction and chlorosis for the 3 species. For maximum yields deeper water table depths were needed with loam than with sandy loam soil. Yield of cabbage was not significantly increased at water table depths greater than 30 cm in either soil. Squash yield was highest at water table depths of 61-76 cm in the fine sandy loam and 91-102 cm in the loam soil. Tendergreen yield was not significantly increased by water table depths greater than 61 cm in either soil. Copyright 1973, Biological Abstracts, Inc.

W75-09918

**ON THE RESULTS OF PRACTICAL PROTECTION OF VALUABLE AGRICULTURAL CROPS FROM HAIL BY THE THRI (ZAKNIGMI) METHOD (THE RESULTS OF FIVE YEARS' WORK, 1969-1973),** Zakavkazskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tiflis (USSR).

For primary bibliographic entry see Field 3B.

W75-09969

**IRRIGATION EFFICIENCIES IN PRODUCING CALORIES AND PROTEINS: AN ANNOTATED BIBLIOGRAPHY,** California Univ., Los Angeles. School of Public Health.

E. L. Rada, and R. J. Berquist.  
California Water Resources Center, Davis, Report No 31, February 1975. 65 p, 280 ref.

Descriptors: \*Irrigation efficiency, \*Bibliographies, \*Crop production, \*Agriculture, \*Nutrient requirements, Proteins, Water distribution(Applied), California, Water utilization, Energy conversion.

Identifiers: \*Food production, Calories.

This annotated bibliography concerns the use of distributed water for the production of food crops eventually converted to human inputs of calories (energy) and proteins (growth-energy). A thorough literature search of the 1960's to 1970's was made dealing with various aspects of the questions, i.e., when measured in calorie-protein terms which crops are the most nutritious and which are most efficiently produced relative to distributed water used. The literature was searched by keying on certain words, such as water use, calories, food production and so forth. Concentration was largely on references dealing with plant production and their relation to water usage. Entries dealing with nutrient-composition of foods came primarily from USDA publications. References on crop production focused primarily, though not exclusively, on California. In the water resource area, the California Department of Water Resources, the University of California-Davis Departments of Agriculture and Engineering and Water Sciences, and the Giannini Foundation of Agricultural Economics at UC-Berkeley yielded the majority of entries. References include reports and articles on water resource development, irrigation efficiency, and consumptive use of water. A cross-reference by numbers is provided according to subtopics under the headings of nutrition and energy, water resources, and agricultural production. (Jones-Wisconsin)

W75-10076

**SPRINKLING CATTLE FOR RELIEF FROM HEAT STRESS,** California Univ., Davis. Dept. of Agricultural Economics.

S. R. Morrison, R. L. Givens, and G. P. Lofgreen. J Anim Sci, Vol 36, No 3, p 428-431, 1973. Illus.

Identifiers: \*California, \*Cattle, Feed, Heat stress(Cattle), Refrigeration, Sprinkling, \*Imperial Valley(Calif).

Sprinkling cattle under shades during the summer in the Imperial Valley of California for 1 min every 30 min when the temperature was above 80°F (27°C) resulted in significantly higher feed consumption and rate of gain compared with cattle under shades and not sprinkled. Efficiency of feed conversion, although favoring the sprinkling treatment, was not significantly improved over that of uncooled cattle. Sprinkling was as effective as a refrigerated air conditioned barn at 75°F (24°C) in 1 trial and more effective during a 2nd trial. Sprinkling and refrigeration promoted greater comfort as indicated by lower respiratory rates and body temperatures in the afternoon. Both noncooled and cooled cattle consumed more feed and gained more weight with 40 ft<sup>2</sup> (3.7 m<sup>2</sup>)/head of space than with 20 ft<sup>2</sup> (1.86 m<sup>2</sup>). Copyright 1973, Biological Abstracts, Inc.

W75-10082

**A STUDY OF THE EFFECTS OF WATER INSTITUTIONS ON PLANNING AND MANAGEMENT OF WATER RESOURCES IN UTAH,** Utah State Univ., Logan. Dept. of Civil Engineering.

For primary bibliographic entry see Field 6E.

W75-10130

**DEW DURATION IN CENTRAL IOWA,** Iowa State Univ., Ames. Dept. of Agronomy.

R. H. Shaw.  
Iowa State J Res. Vol 47, No 4, p 219-227, 1973, Illus.

Identifiers: \*Dew duration, Grass, \*Iowa, \*Pathogens(Plants), Reproduction, Soybean, Wetness, Corn(Field), Relative humidity.

Dew provides periods of crop wetness for reproduction of many plant pathogens. Dew observations were made at Ames, Iowa, during the growing seasons of 1953 and 1954. On rainless nights dew was present 50% of the hours from 8 p.m.-6a.m. on soybeans and 41% on corn in 1953, and 63% of the time on soybeans in 1954. On rainless nights for the June-Aug. period, dew collected on 88% of the nights on grass, 85% on soybeans and 73% on corn in 1953 and on 88% and 86% of the nights on grass and soybeans, respectively, in 1954. Hours of relative humidity (in the field) above 85% caused 29%-64% of the variation in dew duration. Copyright 1973, Biological Abstracts, Inc.

W75-10212

**AN UNUSUAL BROWN ROT OUTBREAK IN A FLORIDA CITRUS GROVE FOLLOWING SPRINKLER IRRIGATION WITH PHYTOPHTHORA-INFESTED WATER,** Agricultural Research and Educational Center, Lake Alfred, Fla.

J. O. Whiteside, and T. W. Oswalt.  
Plant Dis Rep. Vol 57, No 5, p 391-393, 1973.  
Identifiers: \*Brown rot, Citrus, \*Florida, Infested, Irrigation, \*Phytophthora-citrophthora, \*Sprinkler irrigation.

A report is given of a serious and apparently unique outbreak of on-tree brown rot on 'Marsh' and 'Duncan' grapefruit following overhead sprinkler irrigation. A strain of Phytophthora citrophthora with exceptionally high fruit-infecting ability was responsible for the attack. This fun-

### Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3F—Conservation In Agriculture

gus was not detected within the soil of the grove itself, but was traced to the water supply.—Copyright 1973, Biological Abstracts, Inc.  
W75-10245

### 4. WATER QUANTITY MANAGEMENT AND CONTROL

#### 4A. Control Of Water On The Surface

**PROJECT EVALUATION IN WATER RESOURCES: BUDGET CONSTRAINTS,** Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6A.  
W75-09851

**SOCIOLOGICAL IMPACT OF A FLOOD CONTROL RESERVOIR, HOWARD, PENNSYLVANIA,** Pennsylvania State Univ., Inst. for Research on Land and Water Resources. University Park.  
For primary bibliographic entry see Field 6B.  
W75-09854

**THE ECONOMIC IMPACT OF A SMALL RECREATION-ORIENTED RESERVOIR,** University of Southern Mississippi, Hattiesburg. Bureau of Business Research.  
For primary bibliographic entry see Field 6B.  
W75-09857

**SILTATION RATES AND LIFE EXPECTANCIES OF SMALL HEADWATER RESERVOIRS IN MONTANA,** Montana Univ., Missoula. School of Forestry.  
For primary bibliographic entry see Field 2J.  
W75-09858

**MECHANICAL MANAGEMENT OF AQUATIC VEGETATION: ANALYTICAL STUDIES OF UNIT OPERATIONS POTENTIALLY USEFUL IN THEIR PROCESSING,** Wisconsin Univ., Madison. Dept. of Mechanical Engineering.  
S. H. SY.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 593, \$7.50 in paper copy, \$2.25 in microfiche. Ph D Thesis, 1974. 216 p, 25 tab, 34 fig, 43 ref, 5 append. OWR B-078-WIS(1). 14-31-0001-3947.

Descriptors: \*Dewatering, \*Separation techniques, \*Harvesting, \*Aquatic weed control, \*Mulching, Mechanical equipment, Treatment, Feeds, \*Wisconsin, Management.  
Identifiers: Dane County(Wis).

Dewatering processes and solid-liquid separation methods applied to harvested aquatic vegetation as an aid to handling and/or utilizing it are described. An 'initiation pressure' was defined and was shown to be a useful quantitative parameter indicative of the ease of dewatering aquatic vegetation. Subsequent use of this parameter improved the validity of a moisture predicting function. For the case of constant pressure dewatering, two separate mechanisms were observed (1) a short 'initial rate' period and (2) a 'falling rate' period characterized by a slow decay in the rate of moisture expression. A second-order rate mechanism was derived to describe this latter period. Solids content in the expressed liquid remained relatively constant over the pressing period. A significant fraction of the solids in the expressed liquid could be recovered by gravity separation. The chemical composition and variations in composition of Eurasian watermilfoil were

investigated. Peak crude protein content was only slightly lower than that of alfalfa. Calcium and xanthophyll contents were high and crude fiber low relative to forage crops. The composition appears to make Eurasian watermilfoil a possibility in low-fiber rations in addition to its present use as a soil additive. (Koegel-Wisconsin)  
W75-09861

**WAVE QUENCHING DEVICE,** Baker Hydro, Inc., Irvine, Calif. (assignee) D. A. Stanwood.  
US Patent No 3,886,602, 5 p, 8 fig, 7 ref; Official Gazette of the United States Patent Office, vol 935, No 1, p 19, June 3, 1975.

Descriptors: \*Patents, \*Floats, \*Turbulence, Swimming, Swimming pools.  
Identifiers: Wave damping, Float design.

A float to be strung on lines to mark the lanes for swimmers in a racing meet is molded in one piece from plastic and is comprised of wafer components preferably being discs and interconnecting barrier elements. The wafers are uniformly spaced along the axis of the float and normal to that axis. The barrier elements are normal to and extend between confronting faces of adjacent wafers. Four barrier elements comprise a set in the space between two adjacent wafers and they are in a relationship of quadrature. Longitudinally of the float the barrier elements are aligned in four sets paralleling the axis of the float. The wafers are thin in relation to the spacing between adjacent ones and their exposed edges are rounded. A bore extends through the float from end to end so that the floats may be strung end to end on a line to mark the boundary between adjacent racing lanes. Waves striking the rounded edges of the wafers are not significantly reflected back toward the swimmer by the edges of the wafers but instead slide off sideways and enter the space between adjacent wafers. The wafers direct the turbulent water entering the spaces between the wafers to impinge upon the faces of the barrier elements or baffles which resist the force of the turbulent water due to the freedom of the float to rotate on the line which supports it. Thus wave energy is absorbed and turbulence quelled. (Sinha-OEIS)  
W75-09871

**DRAINAGE SYSTEM COOPERATES WITH NATURE,** Woodland Development Corp., Houston, Tex. J. A. Veltman.  
Public Works, Vol 106, No 2, p 86-87, February, 1975. 1 fig.

Descriptors: \*Drainage, \*Storm runoff, \*Planning, Aquifers, Groundwater, Project planning, \*City planning, Water resources development, Flood control, Land management.  
Identifiers: Woodland(Tex), Houston(Tex).

A natural drainage system is being developed to treat storm water runoff for a planned city called The Woodlands, near Houston, Texas. The existing natural drainage system, Panther Creek, will be used as fully as possible as the trunk line for the system. Where natural drainage is not efficient, due to lack of slope or topography, shallow swales lined with native vegetation will be constructed to handle the water flow. In addition, retention ponds and other flood control devices will be used. Pipes and concrete systems will be used only when urban activity causes storm flow to exceed the system's natural capacities. The proposed plan will result in a city with a population of 150,000 with park-like areas throughout. The system should be effective in dealing with a peak flow of storm water runoff, as compared to a conventional system of curbs, gutters, storm sewers, and concrete ditches. Protection of the water resources including two main aquifers (recharge capacity of 65 mgd) will be incorporated into the design. Penetration of several shallow clay layers

will be prohibited, so that vertical groundwater movement will be impeded; residential buildings built over the aquifers will be without basements to avoid puncturing these layers. The system includes the use of existing swales, ponds, low spots, and streams to hold rainfall rather than widespread building of storm sewers. The system will also discharge underground water tables, trap erosion sediment and diminish sudden runoffs which could cause flash flooding and related damage. (Prague-FIRL)  
W75-09942

**A METHOD FOR PREDICTING FLOOD WATER RUNOFF OF THE RIVER STEYR (EIN VERFAHREN ZUR VORHERSAGE DER HOCHWASSERABFLUSSSE DER STEYR),** W. Kresser, and D. Gutknecht.

Oesterreichische Wasserwirtschaft, Vol 26, No 11/12, p 249-259, 1974. 11 fig, 3 tab, 7 ref.

Descriptors: \*Flood forecasting, \*Runoff, Model studies, Monitoring, Data analysis, Precipitation(Atmospheric), Flood control, Rivers.  
Identifiers: \*River Steyr(Germany), Prediction models.

A model for the prediction of flood water runoff in the Steyr River, Austria, is presented. The method is based on a precipitation runoff model using precipitation monitoring data. This runoff model consists of: a model for the determination of the runoff formation; another model for the determination of the direct runoffs; and a third model for calculating basic runoffs for the characterization of runoff occurring during the precipitation event. The prediction model gave satisfactory but no optimal results. The runoff formation model is the weakest link of the prediction method. A rapid decrease in the accuracy of the predictions with the extension of the prediction period was found, corresponding to a rapid reaction of the river to intense precipitation. (Takacs-FIRL)  
W75-09943

**PROCEEDINGS OF PUBLIC WORKSHOP CONFERENCE ON WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN CENTRAL MINNESOTA,** Minnesota Univ., St. Paul. Water Resources Research Center.

For primary bibliographic entry see Field 6B.  
W75-10005

**PROCEEDINGS OF PUBLIC FORUM ON WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN SOUTHWESTERN MINNESOTA,** Minnesota Univ., St. Paul. Water Resources Research Center.

For primary bibliographic entry see Field 6B.  
W75-10006

**PROCEEDINGS OF PUBLIC FORUM ON WATER RESOURCES PROBLEMS IN SOUTHEASTERN MINNESOTA,** Minnesota Univ., St. Paul. Water Resources Research Center.

For primary bibliographic entry see Field 6B.  
W75-10007

**APPLICATIONS OF INTEGER AND QUADRATIC PROGRAMMING TO FLOOD-PLAIN LAND USE MANAGEMENT,** Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.

For primary bibliographic entry see Field 6F.  
W75-10008

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

**MANAGEMENT PRACTICES AFFECTING QUALITY AND QUANTITY OF IRRIGATION RETURN FLOW,**  
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.  
For primary bibliographic entry see Field 5G.  
W75-10019

**SURFACE WATER DATA, REFERENCE INDEX, CANADA 1974.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10064

**HISTORICAL STREAMFLOW SUMMARY, BRITISH COLUMBIA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10065

**HISTORICAL STREAMFLOW SUMMARY, ONTARIO, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10066

**HISTORICAL STREAMFLOW SUMMARY, ALBERTA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10067

**HISTORICAL STREAMFLOW SUMMARY, YUKON AND NORTHWEST TERRITORIES, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10068

**HISTORICAL STREAMFLOW SUMMARY, MANITOBA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10069

**HISTORICAL STREAMFLOW SUMMARY, SASKATCHEWAN, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10070

**HISTORICAL STREAMFLOW SUMMARY, ATLANTIC PROVINCES, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
For primary bibliographic entry see Field 7C.  
W75-10071

**WASTING A RIVER,**  
California Univ., Berkeley. Coll. of Natural Resources.  
For primary bibliographic entry see Field 6B.  
W75-10116

**THE BENEFIT-COST RATIO IN RESOURCE DEVELOPMENT PLANNING,**  
Economic Research Service, Washington, D.C.  
For primary bibliographic entry see Field 6B.  
W75-10117

**PRIMARY ECONOMIC IMPACT OF THE GULF L'TRACOASTAL WATERWAY IN TEXAS,**  
Texas Engineering Experiment Station, College Station.  
For primary bibliographic entry see Field 6B.  
W75-10120

**THE EFFECTS OF AUTHORIZATION FOR WATER IMPOUNDMENTS ON SHORELAND TRANSITION,**  
North Carolina Univ., Chapel Hill. Center for Urban and Regional Studies.  
For primary bibliographic entry see Field 6B.  
W75-10126

**THE DISCHARGE OF SOUTH CAROLINA STREAMS AS IT RELATES TO LINK MAGNITUDE,**  
South Carolina Univ., Columbia. Dept. of Geology.  
For primary bibliographic entry see Field 2E.  
W75-10134

**UTILIZATION OF AERIAL PHOTOGRAPHS FOR MEASURING LAND USE CHANGES IN WATERSHEDS,**  
Clemson Univ., S.C. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 4C.  
W75-10136

**A MODEL FOR EARTHQUAKES NEAR PALISADES RESERVOIR, SOUTHEAST IDAHO,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 8B.  
W75-10139

**DISCHARGE MEASUREMENTS AT LOW-FLOW PARTIAL-RECORD STATIONS IN IOWA.,**  
Geological Survey, Iowa City, Iowa.  
For primary bibliographic entry see Field 7C.  
W75-10144

**HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1973,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10150

**A TECHNIQUE FOR ESTIMATING THE MAGNITUDE AND FREQUENCY OF FLOODS IN MAINE,**  
Geological Survey, Augusta, Maine.  
For primary bibliographic entry see Field 2E.  
W75-10155

**EFFECTS OF LOWERING INTERIOR CANAL STAGES ON SALT-WATER INTRUSION INTO THE SHALLOW AQUIFER IN SOUTHEAST PALM BEACH COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 4B.  
W75-10156

**EVALUATION OF RESERVOIR SITES IN NORTH CAROLINA—REGIONAL RELATIONS FOR ESTIMATING THE RESERVOIR CAPACITY NEEDED FOR A DEPENDABLE WATER SUPPLY,**  
Geological Survey, Raleigh, N.C.  
F. E. Arteaga, and E. F. Hubbard.  
Water-Resources Investigations 46-74, February 1975. 60 p, 16 fig, 1 plate, 4 tab, 13 ref.

Descriptors: \*Reservoir design, \*Reservoir evaporation, \*North Carolina, Frequency analysis, Frequency curves, Estimating, Water storage.  
Identifiers: \*Draft-storage-frequency relations.

Draft-storage-frequency relations, which show the storage required for a reservoir to furnish a specified withdrawal or draft are regionalized for four zones in North Carolina using the mean annual flow of the streams as an index. The differences between the zones primarily reflect differences in the variability of streamflow. To as-

sure the available draft will fall below 75% of the mean annual flow of a stream only once in 50 years on the average, a reservoir in the mountains would need a usable storage capacity of 45% of the mean annual runoff of the impounded stream. In comparison, reservoirs in parts of the Piedmont furnishing a draft of 75% of the mean annual flow must have usable storage equal to 60% of the mean annual runoff of the stream. In the inner Coastal Plain the storage required increases to 84% and in the outer Coastal Plain to about 110%. These increases in storage are indicative of the general increase in streamflow variability, both seasonally and between years, from west to east in the State. Net evaporative draft also varies from west to east. For instance, a reservoir impounding a Piedmont stream, and designed with a 5 percent chance of deficiency, will have a net evaporative draft about twice as large as a similar sized reservoir in the Coastal Plain. In the mountains, annual precipitation always exceeds evaporation because of the cooler temperatures and higher rates of precipitation. (Knapp-USGS)  
W75-10159

**LOW-FLOW CHARACTERISTICS OF WISCONSIN STREAMS AT SEWAGE-TREATMENT PLANTS,**  
Geological Survey, Madison, Wis.  
For primary bibliographic entry see Field 5B.  
W75-10163

**RESERVOIR RELEASE ROUTING MODEL FOR THE UPPER ARKANSAS RIVER BASIN OF COLORADO,**  
Geological Survey, Denver, Colo.  
R. R. Luckey, and R. K. Livingston.  
Colorado Water Conservation Board, Denver.  
Water Resources Circular No 27, 1975. 44 p, 12 fig, 1 tab, 5 ref, 2 append.

Descriptors: \*Reservoir releases, \*Model studies, \*Colorado, River basins, Methodology, Computer models, Input-output analysis, Water yield, Bank storage, Channel flow, Inflow, Discharge(Water), Correlation analysis, Reservoir operation.  
Identifiers: \*Arkansas River basin(Colo), Twin Lakes(Colo), Colorado Canal.

A model for routing reservoir releases has been developed that accounts for channel storage, bank storage, inadvertent diversions (additional diversions caused by increased river stage), and travel time. Channel storage in the reach is calculated each time step as a linear function of the inflow to the reach. Inadvertent diversion is a function of the size of the release in the reach and the initial flow in the reach. Bank storage is a function of the inflow to the reach, outflow from the reach, and aquifer parameters. Because bank storage and outflow are interdependent, repetitive calculations are made until the calculated rate of bank storage ceases to change significantly. The final outflow from a reach then becomes the inflow to the next reach. This model has been tested by routing reservoir releases from Twin Lakes to the Colorado Canal in the upper Arkansas River basin. During periods when conditions on the river are relatively stable, the model produces hydrographs that are in excellent agreement with the observed hydrographs. (Woodard-USGS)  
W75-10165

**ESTIMATING MEAN STREAMFLOW IN THE DUCESNE RIVER BASIN, UTAH,**  
Geological Survey, Salt Lake City, Utah.  
For primary bibliographic entry see Field 2E.  
W75-10166

**EFFECT OF WIND WAVES AND WIND TIDES ON THE OPTIMUM CONTROL OF LARGE LAKES,**  
Arizona Univ., Tucson. Bureau of Business Research.  
W. Metler, I. Bogardi, and L. Duckstein.

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

Water Resources Research, Vol 11, No 3, p 397-404, June 1975. 6 fig, 2 tab, 17 equ, 12 ref.

**Descriptors:** \*Lakes, \*Wind tides, \*Waves(Water), Effects, Reservoir releases, Shallow water, Methodology, Optimization, Dynamic programming, Shores, Water levels, Stochastic processes, Water storage, Markov processes, Economic justification, Control, Water policy, Damages, Decision making, Probability, Equations, Mathematical models, Systems analysis, Risks.

**Identifiers:** \*Lake Balaton(Hungary), Water rise, Loss functions, Sensitivity analysis, Discounting, Loss minimization, Event-based model.

Wind waves and wind tides may cause severe damage along large lake or reservoir shores when the average water level is high. Shallow lakes, however, need to maintain a high storage level in order to minimize losses in tourism, navigation and ecology. The optimal release policy for a large and shallow lake subject to the double uncertainty of average monthly hydrologic input and instantaneous wind-induced water rise is calculated. The case of Lake Balaton in Hungary is used to illustrate the methodology. Loss functions are obtained for each lakeshore section; losses due to unfavorable (high or low) water level are given on a monthly basis, and dynamic losses due to waves and wind tides are calculated by using an event-based model. The physical model is defined with the associated events and transformation functions. Then economic loss functions are introduced and accumulated around the lake. A stochastic dynamic programming formulation yields an optimum release policy whose sensitivity to loss function and discount factor is examined. (Bell-Cornell)

W75-10204

#### WATER AND WATER PROBLEMS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND SOME POSSIBLE SOLUTIONS.

Southwest Florida Water Management District, Brooksville.

For primary bibliographic entry see Field 3C.  
W75-10207

#### COLORADO RIVER-FLOW MANAGEMENT, Bureau of Reclamation, Denver Colo.

R. E. Glover, C. A. Nelson, and J. I. Sanders. Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY11, Paper No 10934, p 1519-1535, November 1974. 4 fig, 3 tab, 15 equ.

**Descriptors:** \*Colorado River, \*Streamflow, \*Management, Hydraulics, \*Dams, Storage, Water delivery, Conservation, Control, Operations, Diversion, Flow characteristics, Water supply, Digital computers, Downstream, Return flow, Powerplants, Gaging stations, Storms, Reach(Streams), Communication, Data transmission, Natural streams, Equations, Velocity, Effects, Estimating, Lakes.

**Identifiers:** \*Transient flow, Prediction, Flow routing, Losses.

A method of computing transient flow changes in a flowing stream is described. The results of more than five years of experience in the use of this method for estimating flows at the gaging stations of the 147-mile Parker-Imperial reach of the Colorado River are summarized. An account is made of digital computer applications which enable tabulations of the expected flows at the gaging stations for each hour of the ensuing 24 hours to be made and transmitted to the Boulder City Office of the USBR in time to be available at the beginning of each work day. Tabulation covering 72 hours is prepared for weekend operations. Demonstrated is the usefulness for tightening control of the river for purposes of preventing the waste of water. (Bell-Cornell)

W75-10208

#### TRANSIENT CONTROL IN LOWER SACRAMENTO RIVER, Bureau of Reclamation, Sacramento, Calif. Applications Branch.

F. J. Gientke. Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY3, Paper No 10418, p 405-424, March 1974. 14 fig, 28 equ, 8 ref, 3 append.

**Descriptors:** \*Open channel flow, \*Unsteady flow, \*Hydraulics, \*Weirs, \*Gates, Flood forecasting, Flood control, Projects, Operation, Management, Equations, Mathematical models, Systems analysis, \*California.

**Identifiers:** \*Sacramento River(Calif), Method of characteristics, Geometry.

The transient controlling gate and valve-stroking concept recently developed and verified by Streeter and Wylie at the University of Michigan is extended to the operation of the Sacramento weir gates during periods of high flows in the river. The weir is located several miles upstream from Sacramento and is the only one operated at high stages to maintain a 29.0-ft. maximum stage at the Sacramento 'I' Street gage. High inflow from the regulated American River between the weir and the gage often causes flow to reverse in a portion of the Sacramento River, but this complication is easily handled by the method of characteristics. Although the gate-stroking technique is extended to operation of the Sacramento weir, the same extension can be made to natural and artificial channels in which a control structure is located. The three sections analyzed are: (1) basic theory of unsteady flow and the development and application of the characteristic equations; (2) the geometry of the lower Sacramento River; and (3) transient control of the lower Sacramento River. The gate operation technique allows the determination of whether flood conditions now developing in the Sacramento or release schedules anticipated from upstream dams can be conveyed within the system without violating the project flood plain. Furthermore, extension of this type of scheme could permit the internal optimization of release schedules and weir operation such that the operation of the conveyance system is optimized. Included is an appendix with more detailed treatment on development of the unsteady and characteristic equations. (Bell-Cornell)

W75-10219

#### DIGITAL PROGRAM FOR WATER NETWORK ANALYSIS, Water Research Association, Marlow(England).

Economics Group. For primary bibliographic entry see Field 7C.  
W75-10220

#### A SENSITIVITY ANALYSIS OF SIMULATED RIVER BASIN PLANNING FOR CAPITAL BUDGETING DECISIONS, Idaho State Univ., Pocatello. Coll. of Business.

For primary bibliographic entry see Field 6A.  
W75-10223

#### SHORTCUT METHODS TEST ALGICIDES, Wisconsin Univ., Madison.

For primary bibliographic entry see Field 5G.  
W75-10234

#### WATERWAY MONITORING SYSTEM.

For primary bibliographic entry see Field 7A.  
W75-10248

#### FORECASTING WATERSHED POLLUTION USING A MODEL, Adaptronics, Inc., McLean, Va.

For primary bibliographic entry see Field 5A.  
W75-10249

#### WATER QUALITY ROUTING OF UNSTEADY RIVER FLOW BY FINITE ELEMENT METHOD, Osaka Univ. (Japan). Dept. of Civil Engineering.

For primary bibliographic entry see Field 5B.  
W75-10252

#### PRESERVATION AND ENHANCEMENT OF THE AMERICAN FALLS AT NIAGARA, American Falls International Board, Buffalo, N.Y.

For primary bibliographic entry see Field 6E.  
W75-10290

#### AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 8A.  
W75-10292

#### TRED AVON RIVER, TALBOT COUNTY, MARYLAND (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineering District, Baltimore, Md. Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-MD-73-1122-F, \$4.75 in paper copy, \$2.25 in microfiche. July 1973, 82 p, 6 tab, 6 map.

**Descriptors:** \*Environmental effects, \*Maryland, \*Dredging, \*Channel improvement, \*Estuaries, Transportation, Spoil banks, Navigation, Navigable waters, Benthos, Channels, Streams, Estuarine environment, Federal government, Governmental interrelations, Local governments, Economic impact.

**Identifiers:** \*Environmental impact statements, \*Talbot County(Md), Navigation obstructions.

This project entails the hydraulic dredging of approximately 2 miles of channels in the Tred Avon River, consisting of two navigation channels 12 feet deep and 150 feet wide and a turning basin 12 feet deep and 250 feet wide. Approximately 333,000 cubic yards of material will be removed and deposited in any of five nearby disposal areas. The river is an estuarine stream draining about 29,300 acres of primarily agricultural land on the eastern shore of Maryland. The deepened channel will reduce navigation hazards to commercial vessels, thereby enhancing the economic development of the region. Greater sport fishing may also be generated. Project dredging will disturb or remove benthic organisms, temporarily increase turbidity in the river, and destroy wildlife habitat at the disposal areas. Alternative considered were no action, various channel depths and widths, and alternate spoil disposal methods and sites. The sites chosen were considered to be the least valuable environmentally. The loss of productivity in the area due to destruction of benthic organisms and use of agricultural lands for disposal sites is expected to be minimal. Opposition to this project centers around the destruction of oyster beds and the use of wetlands as disposal sites. (Deckart-Florida)

W75-10295

#### MINUTES OF THE 89TH MEETING, (ARKANSAS-RED-WHITE RIVER BASINS INTER-AGENCY COMMITTEE).

Arkansas-White-Red Basins Inter-Agency Committee, Wichita, Kans.

Held on October 25-25, 1974. 91 p, 2 fig, 11 append.

**Descriptors:** \*Watersheds(Basins), \*River basin development, \*Water resources development, \*Flood protection, \*Arkansas, Basins, River basins, Watershed management, Federal government, Administrative agencies, Legislation, Flood control, Non-structural alternatives, Planning, Water management(Applied), Weather modification, Reservoirs, River basin commissions, Rivers, Dams.

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Groundwater Management—Group 4B

Identifiers: \*Environmental policy, \*Arkansas-White-Red basins.

Part A details the opening position of the meeting where section twenty-two and seventy-three of the Water Resources Development Act of 1974 were discussed. Further items considered were water requirements for electric power generation, as well as watershed and weather modification activities. Part B consists of the business session, and the presentation of reports by the Exchange of Program Information Committee, the Ad Hoc Committee on National Assessment, and the Administrative Committee Report. Appendices in part C contain statements of those who made formal presentations and includes the texts of reports submitted. General discussion related to the utilization and conservation of water and related land resources, and projects involving flood protection through the use of nonstructural alternatives. (Fernandez-Florida)  
W75-10300

#### SURFACE WATERS AND THE CIVIL LAW RULE,

Long and Aldridge, Atlanta, Ga.

For primary bibliographic entry see Field 6E.  
W75-10304

#### RULES AND REGULATIONS, SOUTHWEST WATER MANAGEMENT DISTRICT (FLORIDA).

Southwest Florida Water Management District, Brooksville.  
For primary bibliographic entry see Field 6E.  
W75-10306

#### RULES OF CENTRAL AND SOUTHERN FLOOD CONTROL DISTRICT, CHAPTER 16CA, WITH COMMENTARY.

Central and Southern Florida Flood Control District, West Palm Beach.  
For primary bibliographic entry see Field 6E.  
W75-10307

#### MOUNTAIN PARK RECLAMATION PROJECT, OKLAHOMA—NUECES RIVER PROJECT, TEXAS.

Hearings—Subcomm. on Water and Power Resources—Comm. on Interior and Insular Affairs, U.S. Senate, 93d Cong, 2d Sess, July 18, 1974. 88 p, 3 map, 1 tab, 2 chart.

Descriptors: \*Reclamation, \*Water supply, \*Water supply development, \*Texas, Canyons, Dams, \*Oklahoma, Industrial water, Reservoirs, Water, Appropriation, Mountains, Parks, Municipal water, Construction, Rivers.

Identifiers: Congressional hearings, Nueces River (Tex).

The subcommittee on Water and Power Resources met to take testimony on S.3704 and S.3513, both of which relate to reclamation projects. The former would increase the level of appropriations which have been authorized for the Mountain Park reclamation project in southwestern Oklahoma. The municipal and industrial water supply project is presently under construction. The latter would authorize the Secretary of the Interior to construct, operate, and maintain the Nueces River project in southeastern Texas. The proposed project includes the Choke Canyon Dam and Reservoir so that the flows of the Nueces River could be regulated, primarily to provide municipal and industrial water supplies to Corpus Christi and several smaller communities. The total estimated cost of the project would be about 64 million dollars. (Gagliardi-Florida)  
W75-10319

#### AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH APPENDIX A (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Washington, D.C.  
For primary bibliographic entry see Field 8A.  
W75-10331

For primary bibliographic entry see Field 4A.  
W75-09942

#### 4B. Groundwater Management

##### STATUS OF LAND SUBSIDENCE DUE TO GROUND-WATER WITHDRAWAL ALONG THE MISSISSIPPI GULF COAST,

Mississippi State Univ., Mississippi State Dept. of Geology and Geography.

For primary bibliographic entry see Field 2F.  
W75-09856

##### GEOTHERMAL BRINE ENERGY TO GENERATE POWER,

Chevron Research Co., San Francisco, Calif. (assignee).

For primary bibliographic entry see Field 8C.  
W75-09863

##### DISPOSAL OF WASTE STREAMS CONTAINING ASBESTOS,

Dow Chemical Co., Midland, Mich. (assignee).

For primary bibliographic entry see Field 5E.  
W75-09876

##### APPARATUS FOR CONTROLLING THE LEVEL OF SUBSURFACE WATER,

Moretrench American Corp., Rockaway, N.J. (assignee)

E. J. Moore.

US Patent No 3,888,605, 3 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 935, No 2, p 676, June 10, 1975.

Descriptors: \*Patents, \*Subsurface waters, \*Wells, \*Water levels, \*Groundwater movement, Equipment, Valves, Water utilization.

Systems for removing water from the ground include a series of well points sunk into the ground at spaced intervals and a pumping unit for drawing water out of the ground through the well points. The apparatus of this invention automatically adjusts the flow of water to the pump from each well point in accordance with the amount of air being drawn into the particular well point. At the same time, the apparatus maintains a reduced pressure in the well point, whereby the flow of water to the pump is re-established when the air drawn into the well point decreases. A float-actuated valve connects the pump and the well point and controls the flow of water to the pump in accordance with the flow rate of water drawn into the well point. An air passageway bypasses the valve to provide a reduced pressure condition in the pipe when the valve is closed. (Sinha-OEIS)  
W75-09880

##### AQUIFER PARAMETERS BY A CHEMICAL TRACER TECHNIQUE: NON LINEAR MIXING IN THE ROSWELL CONFINED AQUIFER,

New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.

For primary bibliographic entry see Field 2F.  
W75-09893

##### UNDERGROUND LIQUID WASTE DISPOSAL,

American Society of Civil Engineers, New York. Task Committee on Underground Liquid Waste Disposal.

For primary bibliographic entry see Field 5E.  
W75-09938

##### DRAINAGE SYSTEM COOPERATES WITH NATURE,

Woodland Development Corp., Houston, Tex.

##### PROCEEDINGS OF PUBLIC WORKSHOP CONFERENCE ON WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN CENTRAL MINNESOTA.

Minnesota Univ., St. Paul. Water Resources Research Center.

For primary bibliographic entry see Field 6B.  
W75-10005

##### GROUND WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES,

Geraghty and Miller, Port Washington, N.Y.

For primary bibliographic entry see Field 5B.  
W75-10023

##### MEASURING EXTERNAL EFFECTS OF SOLID WASTE MANAGEMENT,

Institute for Policy Analysis, La Jolla, Calif.

For primary bibliographic entry see Field 5B.  
W75-10024

##### GROUNDWATER POLLUTION: PROBLEMS AND SOLUTIONS.

For primary bibliographic entry see Field 5B.  
W75-10058

##### EVALUATION OF GROUND WATER RESOURCES: LIVERMORE AND SUNOL VALLEYS,

California State Dept. of Water Resources, Sacramento.

For primary bibliographic entry see Field 2F.  
W75-10063

##### INJECTION-PIPE SYSTEM FOR ARTIFICIAL RECHARGE,

Geological Survey, St. Paul, Minn.

H. O. Reeder.

Available from Sup Doc., D.C. 20402, \$3.15 single journal copy; \$18.90 yearly subscription rate. Journal of Research of the U.S. Geological Survey, Vol 3, No 4, p 501-503, July-August 1975. 2 fig, 4 ref.

Descriptors: \*Artificial recharge, \*Injection wells, \*Groundwater recharge, Methodology, Pipes, Piping systems (Mechanical), Friction, Hydraulics.

Identifiers: \*Injection-pipe system.

An injection-pipe system was designed to utilize pipe friction in the well to maintain positive pressure and to eliminate gas release and air entrainment in the injection water. The size of the injection pipe was selected on the basis of obtaining a unit friction head loss per equal-unit length of pipe for the desired injection rates. The injection rates are 70 gallons per minute through a 11/4-inch heavy duty pipe and 106 gal/min through a 1 1/2-inch heavy duty pipe. A diagram shows flow rates through other pipe sizes. (Woodard-USGS)  
W75-10142

##### GROUND WATER,

Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 2F.  
W75-10143

##### GROUND-WATER DISCHARGE FROM THE EDWARDS AND ASSOCIATED LIMESTONES, SAN ANTONIO AREA, TEXAS, 1974,

Geological Survey, San Antonio, Tex.

For primary bibliographic entry see Field 2F.  
W75-10146

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

#### GEOTHERMAL INVESTIGATIONS IN IDAHO: PART 3, AN EVALUATION OF THERMAL WATER IN THE WEISER AREA, IDAHO, Geological Survey, Boise, Idaho.

H. W. Young, and R. L. Whitehead.  
Idaho Department of Water Resources, Boise, Water Information Bulletin No 30, May 1975. 35 p., 13 fig, 4 tab, 30 ref.

Descriptors: \*Geothermal studies, \*Idaho, \*Thermal water, \*Thermal properties, Water quality, Geophysics, Data collections, Water temperature, Thermal springs.

Identifiers: Geochemical thermometers, Chemical ratios, Weiser area(Idaho).

The Weiser area encompasses about 200 square miles in southwest Idaho and contains two thermal water areas: (1) the Crane Creek subarea, which is 12 miles east of Weiser, Idaho, and (2) the Weiser Hot Springs subarea, which is 5 miles northwest of Weiser. Volcanic and sedimentary rocks of Miocene to Pleistocene age have been faulted and folded to form the northwest-trending anticlines present in much of the area. Basalt of the Columbia River Group or underlying rocks are believed to constitute the reservoir for the hot water. Sampled thermal waters are of a sodium chloride sulfate or sodium sulfate type, having dissolved-solids concentrations that range from 225 to 1,140 mg per litre. Temperatures of sampled waters ranged from 13 to 92 deg C. Minimum aquifer temperatures calculated from chemical analysis of water, using geochemical thermometers, were 170 and 150 deg C in the Crane Creek and Weiser Hot Springs subareas, respectively. Estimated maximum temperatures ranged from 212 to 270 deg C and 200 to 242 deg C, respectively, in these subareas. The probable heat sources for both subareas are (1) young magmatic intrusive rocks underlying the basalt or (2) above-normal temperatures resulting from thinning of the earth's crust. (Woodard-USGS)

W75-10147

#### WATER DEVELOPMENT FOR IRRIGATION IN NORTHWESTERN KANSAS, Geological Survey, Lawrence, Kans.

E. D. Jenkins, and M. E. Pabst.  
Open-file report 4-75, 1975. 39 p., 23 fig, 6 plate, 3 tab, 34 ref.

Descriptors: \*Irrigation wells, \*Groundwater resources, \*Kansas, Semiarid climates, Aquifer characteristics, Pumping, Water yield, Water quality, Chemical analysis, Water level fluctuations, Hydrologic data, Withdrawal, Groundwater recharge.

Northwestern Kansas, an area of 8,050 square miles, is a flat to gently rolling plain that is dissected by the Smoky Hill and Republican Rivers. Loessial soils underlying the plain are ideal for cultivation. The climate is semiarid with the mean annual precipitation ranging from 16 to 21 inches. Precipitation occurring mainly as thunderstorms during the 6-month growing season is four to five times less than the potential evaporation. Principal aquifers are the Dakota Formation, which yields a few gallons per minute of water to domestic and stock wells; the Ogallala Formation, which commonly yields 500 to 1,200 gallons per minute to irrigation wells; and the alluvium, which locally yields as much as 1,500 gpm to irrigation wells. Irrigation from wells has developed principally since the early 1950's. Development has increased from about 100 wells irrigating 10,000 acres in 1950 to about 2,200 wells irrigating 30,000,000 acres in 1972. The rate of withdrawal by irrigation, municipal, and industrial wells in 1972 was about 5,000,000 acre-feet of water per year, of which about 99% was for irrigation. A comparison of water levels measured in 1950 and in 1973 indicates that declines greater than 10 feet are common in much of the area. Declines greater than 30 feet have occurred near Goodland and Colby. (Woodard-USGS)

W75-10152

#### EFFECTS OF LOWERING INTERIOR CANAL STAGES ON SALT-WATER INTRUSION INTO THE SHALLOW AQUIFER IN SOUTHEAST PALM BEACH COUNTY, FLORIDA, Geological Survey, Tallahassee, Fla.

L. F. Land.  
Open-file report FL 75-74, 1975. 59 p., 19 fig, 8 ref.

Descriptors: \*Water level fluctuations, \*Canals, \*Saline water intrusion, \*Groundwater movement, \*Florida, Model studies, Land development, Land management, Environmental effects, Water quality, Analytical techniques, Evaluation, Hydrologic data, Withdrawal, Aquifers, Construction.

Identifiers: \*Lake Worth(Fla), Lowering canal stages.

Land in southeast Palm Beach County, Florida, is undergoing a large-scale change in use, from agricultural to residential. To accommodate residential use, a proposal was made to lower canal stages in the interior part of the area undergoing change. The two main tools used in the investigation were a digital model for aquifer evaluation and an analytical technique for predicting the movement of the salt-water front in response to a change of groundwater flow into the ocean. Test results show that lowering part of the interior canal water levels 3 feet does not affect the aquifer head or salt-water intrusion along the coastal area of Lake Worth. Lowering interior canal water levels by as much as 4 feet would result in some salt-water intrusion. (Woodard-USGS)

W75-10156

#### GROUND-WATER HYDROLOGY OF GARNER VALLEY, SAN JACINTO MOUNTAINS, CALIFORNIA—A MATHEMATICAL ANALYSIS OF RECHARGE AND DISCHARGE, Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 2F.  
W75-10158

#### HYDROLOGIC EVALUATION OF THE HAYSTACK BUTTE AREA WITH EMPHASIS ON POSSIBLE DISCHARGE OF CLASS-I WASTES, EDWARDS AIR FORCE BASE, CALIFORNIA, Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 5B.  
W75-10161

#### HYDROLOGIC RECONNAISSANCE OF THE WAH WAH VALLEY DRAINAGE BASIN, MILLARD AND BEAVER COUNTIES, UTAH, Geological Survey, Salt Lake City, Utah.

J. C. Stephens.  
Utah Department of Natural Resources, Salt Lake City, Technical Publication No 47, 1974. 53 p., 8 fig, 1 plate, 10 tab, 24 ref, append.

Descriptors: \*Groundwater resources, \*Surface-groundwater relationships, \*Available water, \*Water quality, \*Utah, Drainage area, Hydrologic data, Hydrology, Precipitation(Atmospheric), Runoff, Streamflow, Aquifer characteristics, Water wells, Well data, Drillers logs, Chemical analysis.

Identifiers: \*Wah Wah Valley(Utah).

The Wah Wah Valley drainage basin includes about 600 square miles in Millard and Beaver Counties in southwestern Utah. Total runoff averages only about 7,800 acre-feet annually; all streams are ephemeral or intermittent; and surface storage is negligible. Evaporation and transpiration within the basin consume more than 97% of total annual precipitation. There is no surface outflow. Total annual recharge to the groundwater system is about 10,000 acre-feet. Estimates and measurements of discharge from the groundwater system total about 1,500 acre-feet. Recharge to and discharge from the groundwater system are assumed to be equal over a long period of time because there are no known changes of storage in the system. Thus, the difference between the

totals for recharge and discharge represents subsurface outflow from the drainage basin. Most known groundwater sources in the basin yield fresh, very hard water. The highest concentrations of dissolved solids (maximum 4,550 mg/litre) are found in groundwater from igneous rocks, and the lowest (minimum 99 mg/litre) are found in water from quartzite and carbonate rocks. (Woodard-USGS)

W75-10167

#### ISOTOPE HYDROLOGY 1974—A REVIEW OF THE IAEA SYMPOSIUM ON ISOTOPE TECHNIQUES IN GROUNDWATER HYDROLOGY, Paris—Univ. (France). Laboratoire de Geologie Dynamique.

For primary bibliographic entry see Field 5A.  
W75-10172

#### GROUND-WATER'S ROLE IN WATER QUALITY MANAGEMENT, Pennsylvania Dept. of Environmental Resources, Harrisburg, Bureau of Water Quality Management.

For primary bibliographic entry see Field 5G.  
W75-10180

#### REPORT OF COMMITTEE ON SURVEY OF GROUND WATER SUPPLIES IN NEW ENGLAND, New England Water Works Association, Boston (Mass).

Journal of the New England Water Works Association, Vol 89, No 1, p 44-53, March 1975.

Descriptors: \*Groundwater, \*Water supply, \*Surveys, Municipal water, Wells, \*New England, Maintenance, Water treatment, Iron, Manganese.  
Identifiers: Gravel wells.

A survey was made of municipal groundwater supplies in several New England states, in response to concern over the environmental impact of land development and a consequent increase in pollution problems. Gravel packed and gravel-walled wells were examined. The question was posed as to whether such wells have deteriorated or decreased in their capacity. Opinions were obtained on the costs and benefits of preventive maintenance programs for water wells and pumping equipment. Discussed also was treatment of groundwater for inhibiting iron and manganese problems. Public water supplies in Massachusetts, Vermont, Maine, Connecticut, and New Hampshire were discussed. In general, wells have held their quality and capacities for many years longer than previously expected. Maintenance and treatment methods varied, depending upon the population of an area and the demand for groundwater supplies. (Prague-FIRL)

W75-10182

#### DUMPS: A POTENTIAL THREAT TO OUR GROUNDWATER SUPPLIES, Environmental Protection Agency, Washington, D.C. Office of Solid Waste Management Programs.

For primary bibliographic entry see Field 5B.  
W75-10184

#### SOME APPLICATIONS OF THERMAL INFRARED LINESCAN IN WATER RESOURCES STUDIES, Water Research Association, Marlow (England).

For primary bibliographic entry see Field 5A.

W75-10188

#### SUBSURFACE ENVIRONMENT—PRIVATE PROPERTY OR PUBLIC DOMAIN, Virginia Polytechnic Inst. and State Univ., Blacksburg, Water Resources Research Center, W. R. Walker, and W. E. Cox.

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Watershed Protection—Group 4D

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY11, Paper No 10958, p 1699-1705, November 1974. 8 ref.

Descriptors: Hydraulics, \*Water supply, \*Groundwater, \*Legislation, \*Mining, \*Underground structures, \*Storage, \*Waste disposal, \*Injection wells, Energy, Excavation. Identifiers: Airspace, Public administration, \*Gas storage, Land titles.

The increasing utility of subsurface space is resulting in greater interest in the nature of the controls that govern use of this portion of the environment, including water supply, mineral extraction, underground storage, waste disposal, utility location, and commercial and industrial activities. Many of the uses of the subsurface environment are controlled by the institution of property rights. The landowner has exclusive rights to certain minerals located beneath his surface estate and somewhat more limited rights with respect to other natural resources, e.g., groundwater. In addition, property rights definitions often imply exclusive rights to an indefinite depth, thereby technically excluding all uses by others even where use by the surface owner is not feasible. However, there is limited precedent for a restriction of exclusive property rights to a depth subject to actual use as has been done in the case of overlying airspace. Regarding the question of whether the subsurface environment should be private property or at least partially within the public domain, there is no easy answer available as in most cases of public policy; the question will require more consideration in the future. (Bell-Cornell)

W75-10209

HOW MUCH 'RELIABILITY' IS 'ENOUGH',  
For primary bibliographic entry see Field 5A.

W75-10254

THE CAPE COD WATER PROGRAM, A CURRENT ANALYSIS,  
Massachusetts State Geology Office, Boston.  
J. A. Sinnott.

Journal of the New England Water Works Association, Vol 88, No 3, p 238-247, September, 1974. 2 fig. 13 ref.

Descriptors: \*Groundwater, \*Water quality, \*Aquifers, Iron, Sewage disposal, Land treatment, Groundwater management, Hydrologic aspects, \*Massachusetts. Identifiers: \*Cape Cod(Mass), Ocean disposal.

Research on the chemical quality of ground and surface waters has been conducted on Cape Cod for the groundwater aquifer of Barnstable County, Massachusetts. Five deep holes were drilled in 1973, giving the thicknesses of permeable layers and indicating high iron content in all deep water. Water was pumped from three deep well mud holes, and it was concluded that: all water pumped and tested was fresh water, background chloride was 25 ppm; only one aquifer exists under Cape Cod; most usable water occurs before a depth of 160 feet below M.S.L.; and Fe and Mn at greater depths are potential problems. Recommendations include further study of the problem of ocean outfall sewage disposal as opposed to on land treatment and its impact on groundwater quality. (Prague-FIRL)

W75-10283

RULES AND REGULATIONS, SOUTHWEST WATER MANAGEMENT DISTRICT (FLORIDA),  
Southwest Florida Water Management District, Brooksville.  
For primary bibliographic entry see Field 6E.

W75-10306

#### RULES OF CENTRAL AND SOUTHERN FLOOD CONTROL DISTRICT, CHAPTER 16CA, WITH COMMENTARY.

Central and Southern Florida Flood Control District, West Palm Beach.  
For primary bibliographic entry see Field 6E.

W75-10307

#### 4C. Effects On Water Of Man's Non-Water Activities

##### HYDROLOGIC IMPACT OF PLANNED UNIT DEVELOPMENTS,

Maryland Univ., College Park. Dept. of Civil Engineering.

R. H. McCuen, and H. W. Piper.

Journal of the Urban Planning and Development Division, American Society of Civil Engineers, Vol 101, No UPI, p 93-102, May 1975. 5 fig, 4 tab, 11 ref.

Descriptors: \*Storm runoff, \*Urban hydrology, \*Urban runoff, \*Model studies, Runoff forecasting, Urbanization, Infiltration, Hydrographs, Evapotranspiration, Subsurface flow, Roofs.

Identifiers: Planned unit development, Linked-process hydrologic model, Rooftop detention.

The hydrologic impact of planned unit developments (PUD) is examined. A linked-process hydrologic model was formulated to estimate the hydrologic impact of various land-use configurations and examine the potential of various storm water management practices. Components are included to simulate the various hydrologic processes such as interception, infiltration, evapotranspiration, surface retention and detention, subsurface flow, rooftop storage and runoff, overland flow on impervious surfaces, gutter flow and storm sewer system routing, which are involved in transforming rainfall to storm water runoff. Peak discharges from a planned unit development have been computed to be as much as three times those of a single family detached dwelling unit and five times those of undeveloped land use. This fact makes it imperative that storm water management alternatives for PUD be investigated. The linked-process hydrologic model employed in this study appears to be a valid means for estimating the hydrologic impact of PUD and the effect of various storm water management alternatives. The use of rooftop detention may reduce peak discharge by approximately 4%. However, parking lot detention appears to be a more practical detention alternative. (Ort-FIRL)

W75-09919

##### UTILIZATION OF AERIAL PHOTOGRAPHS FOR MEASURING LAND USE CHANGES IN WATERSHEDS,

Clemson Univ., S.C. Dept. of Civil Engineering.

D. B. Stafford, J. T. Ligon, and M. E. Nettles.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 887, \$3.75 in paper copy, \$2.25 in microfiche. Presented at International Symposium on Remote Sensing of Water Resources, June 11-14, 1973, Burlington, Ontario, Canada. 23 p, 4 fig, 3 tab. OWRT A-024-SC3.

Descriptors: \*Watershed(Basins), \*Land use, \*Aerial photography, Remote sensing, \*South Carolina, Urbanization, Runoff, Land management, \*Land classification.

Techniques are described for using existing aerial photographs to investigate land use changes in watersheds. A primary objective was to measure the physical characteristics of historical land use patterns that affect the hydrologic parameters of a watershed. Land use changes in two watersheds in western South Carolina were examined. One of the watersheds has experienced rapid urbanization

in recent years and the other watershed has experienced significant changes in agricultural land use over the past 26 years. Existing aerial photographs taken at approximately five-year intervals were used to delineate, classify, code, and measure the areas of various land use classes in the two watersheds. The land use classes employed were those that had experienced significant changes and which had different runoff characteristics. The area occupied by each land use class was measured on photographic enlargements by using a planimeter. Significant changes in land use were observed in the two watersheds. The results obtained from the research program indicate that the use of existing aerial photographs to obtain data on the historical distribution of land use in watersheds represents a very satisfactory approach that could be employed more widely.

W75-10136

##### HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1973,

Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 7C.

W75-10148

##### HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1973,

Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 7C.

W75-10151

##### PROCEDURE FOR EVALUATING ENVIRONMENTAL IMPACT,

Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 6G.

W75-10164

##### SCENIC RIVERS ASSOCIATION OF OKLAHOMA V. LYNN (SUIT SEEKING DECLARATORY JUDGMENT THAT HUD MUST MAKE AN ENVIRONMENTAL IMPACT STUDY PRIOR TO THEIR CONTEMPLATED ACTIONS).

For primary bibliographic entry see Field 6E.

W75-10313

##### SUTHERLAND V. HICKORY NUT CORP. (ACTION FOR DAMAGES CAUSED BY CONSTRUCTION OF ROADS BY ADJACENT PROPERTY OWNER WHICH ALTERED NATURAL DRAINAGE OF MOUNTAIN LAND).

For primary bibliographic entry see Field 6E.

W75-10315

#### 4D. Watershed Protection

##### SILTATION RATES AND LIFE EXPECTANCIES OF SMALL HEADWATER RESERVOIRS IN MONTANA,

Montana Univ., Missoula. School of Forestry.

For primary bibliographic entry see Field 2J.

W75-09858

##### EFFECTS OF SEDIMENT CONTROL ON SEDIMENT TRANSPORT IN THE NORTHWEST BRANCH ANACOSTIA RIVER BASIN, MONTGOMERY COUNTY, MARYLAND,

Geological Survey, College Park, Md.

For primary bibliographic entry see Field 2J.

W75-10141

##### HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS, 1973,

Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 7C.

W75-10149

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4D—Watershed Protection

**HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1973,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10150

**PRESERVATION AND ENHANCEMENT OF THE AMERICAN FALLS AT NIAGARA.**  
American Falls International Board, Buffalo, N.Y.  
For primary bibliographic entry see Field 6E.  
W75-10290

**BIG HILL LAKE CREEK, KANSAS (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineer District, Tulsa, Okla.  
For primary bibliographic entry see Field 8D.  
W75-10293

**TYBEE ISLAND GEORGIA, BEACH EROSION CONTROL PROJECT (FINAL ENVIRONMENTAL IMPACT STATEMENT).**

Army Engineer District, Savannah, Ga.  
Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-GA-73-1792-F, \$4.25 in paper copy, \$2.25 in microfiche. November 13, 1973. 70 p, 5 tab, 2 map.

Descriptors: \*Environmental effects, \*Georgia, \*Shore protection, \*Groins(Structures), \*Beach erosion, Breakwaters, Jetties, Riprap, Shores coastal structures, Coastal engineering, Flow control, Erosion control, Beaches, Ocean waves, Waves(Water), Barrier islands, Seashores, Recreation, Tidal marshes, Ocean currents, Tides, Wind erosion, Dunes.

Identifiers: \*Environmental impact statements, \*Tybee Island(Ga), Coastal zone management, Beach restoration, Coastal waters.

This project involves the restoration and periodic nourishment of 13,200 feet of ocean beach and construction of a rubble stone terminal groin extending 800 feet seaward. Proposed for the future, if needed, is the placement of two additional rubble groins 760 feet and 670 feet, respectively, and a 1200-foot extension to the terminal groin. Tybee Island is a small barrier island located off the central coast of Georgia. It is comprised of sand dunes and tidal marshes and its beach serves as a major vacation center during the summer months. The island has been continuously subjected to severe erosion due to wave and wind action. The project will result in the restoration and maintenance of the scenic beach area, stabilization of the eroding shoreline, sport fishery habitat, and enhancement of the island community. The project will also temporarily reduce water quality and fish population, and will disrupt the benthid community during construction. Various combinations of groins were considered as were several alternate borrow sites. Involving no irretrievable commitment of resources, the project will enhance the long-term economic development of the region. There is no significant opposition to this proposal. (Deckert-Florida)  
W75-10294

## 5. WATER QUALITY MANAGEMENT AND PROTECTION

### 5A. Identification Of Pollutants

**METHOD AND APPARATUS FOR DETECTING THE PRESENCE OF AN OIL SLICK ON A WATER SURFACE,**  
A. R. Kriebel.  
U S Patent No 3,885,418, 4 p, 8 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 934, No 4, p 1385, May 27, 1975.

Descriptors: \*Patents, \*Oil spills, Oil pollution, \*Water pollution control, \*Pollutant identification, Monitoring, Equipment, Pollution abatement.  
Identifiers: Oil film detector.

The invention provides an in situ floating oil film detector which can continuously monitor a number of local critical areas including the effluent from waste water treatment plants, offshore drilling platforms, piers where oil is being transferred to or from tankers, and inlets to congested water facilities or industrial water intakes where a hazard from floating oil exists. The detector consists of a cylinder positioned within a hollow cylindrical enclosure or shroud, the cylinder being driven about its axis as a constant speed by a drive motor. The detector floats on the water in such a manner that the cylinder is partially submerged in the water surface and, in the absence of an oil slick on the water surface, imposes a known and low value of torque on the drive motor due to the drag on the cylinder by the water film between the cylinder and the shroud. When an oil slick appears on the water surface, the surface of the rotating cylinder becomes coated with oil and the torque on the drive motor is increased, increasing the current through the drive motor. This increase in drive motor current is utilized to trigger a control circuit that signals the presence of the oil. (Sinha-OEIS)  
W75-09865

#### OIL DETECTOR, E. L. Brill.

US Patent No 3,887,907, 5 p, 10 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 421, June 3, 1975.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, Water pollution control, Water quality control, \*Sampling, Skimming, Monitoring, \*Pollutant identification.

Identifiers: Hydrophobic collectors, Oil detection.

A method and apparatus for detecting the presence of oil floating on water is described. A liquid sample is continuously taken from the surface of the water at a substantially steady rate. A sample is collected of predetermined parameter, such as weight or volume, in a predetermined time as constituting one cycle of the operation. Each sample is dumped at the end of each cycle. Using a skimmer which lifts a minimum of liquid from the surface of the water when no oil is present, but which lifts a much larger amount of liquid when oil is present, the invention provides a system wherein if the collected sample is substantially all water, the same is dumped at the end of each cycle without providing a signal. However, if the collected sample involves some volume of oil, the sample reaches a predetermined parameter in less than the usually predetermined time of dumping and therefore the collected sample is utilized to give a signal indicating the presence of oil. A flexible, hose-like elongated collector is utilized which has an attraction for the hydrophobic liquid resting upon the water to pick up the oil collected by an endless loop floating on the water. It is carried out of the water where a doctor blade scrapes the coated material from the collector hose. (Sinha-OEIS)  
W75-09878

#### HUMAN RADIATION DOSE STUDIES. A SELECTED BIBLIOGRAPHY.

Technical Information Center (AEC), Oak Ridge, Tenn.  
Available from the National Technical Information Service, Springfield, Va. 22161, as Rept No TID-3348, \$5.45 in paper copy, \$2.25 in microfiche. Rept No TID-3348, December 1974. 85 p.

Descriptors: \*Bibliographies, \*Radioactivity, Environment, \*Environmental effects, \*Radioactivity effects, Research and development, Biology, Human population, Public health, Abstracts, Publications.

Identifiers: \*Dose studies.

This bibliography contains abstracts of 1010 technical reports and journal articles that have appeared in Nuclear Science Abstracts from January 1962 to June 1973. The scientific and technical journals in which some of the literature appears are available in most science libraries throughout the United States. The abstracts in this bibliography are arranged by NSA volume and abstract number. (Houser-ORNL)  
W75-09890

#### TERRESTRIAL AND FRESHWATER RADIOECOLOGY, A SELECTED BIBLIOGRAPHY,

Washington State Univ., Pullman. Dept. of Zoology.

A. W. Klement, Jr., and V. Schultz.  
Available from NTIS, Springfield, Va. 22161 as Rept. No. TID-3910 (suppl. 9), \$5.45 in paper copy, \$2.25 in microfiche. Rept. No. TID-3910 (Suppl. 9), 1974. 125 p, 1356 ref.

Descriptors: \*Bibliographies, Publications, \*Abstracts, \*Radioactivity, \*Water pollution, \*Thermal pollution, Ecology, Ecosystems, Brackish water, Tracers, Nuclear powerplants, Effluents.

This compilation is based on the same criteria as previous supplements and includes publications which have been noted since publication of Supplement 8. Volume 26 of Nuclear Science Abstracts was perused. References have been obtained from a large number of sources. Many were obtained from reviews and other publications. A number of more general references have been included which are not basically on ecology but may be related, and it is hoped of interest to ecologists, e.g., use of tracers in pesticide studies. An attempt was made to reference publications which were related to field or laboratory studies of wild species of plants and animals with respect to radiation effects or metabolic studies involving radionuclides, including parasites. Included are references on studies of brackish water and brackish water organisms. Reports on thermal pollution and reports concerning organisms at nuclear energy installations are also included even though the particular study did not involve research on radiation effects or cycling of radionuclides. With these exceptions, if a reference is listed it contains material on ionizing radiation even though it is not obvious from the title. (See also W73-07962, W72-04452 and W71-09232). (Houser-Ornl)  
W75-09891

**RADIOACTIVITY FROM SRP OPERATIONS IN A DOWNSTREAM SAVANNAH RIVER SWAMP,**  
Du Pont de Nemours (E.I.) and Co., Aiken, S.C.  
Savannah River Lab.  
For primary bibliographic entry see Field 5B.  
W75-09901

**EFFECT OF ASULAM IN WILDLIFE SPECIES: ACUTE TOXICITY TO BIRDS AND FISH,**  
May and Baker Ltd., Dagenham (England).  
For primary bibliographic entry see Field 5C.  
W75-09903

**IMPORTANCE OF WATER PH IN ACCUMULATION OF INORGANIC MERCURY IN FISH,**  
Wisconsin Univ., Madison. Dept. of Entomology.  
S-C. Tsai, G. M. Boush, and F. Matsumura.  
Bulletin of Environmental Contamination and Toxicology, Vol 13, No 2, p 188-193, February 1975. 2 fig, 1 tab, 17 ref.

Descriptors: \*Mercury, \*Bioassay, \*Hydrogen ion concentration, \*Minnows, Heavy metals, Laboratory tests, Absorption, \*Pollution identification.  
Identifiers: \*Bioaccumulation, \*Tissue analysis.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

The factors that effect the translocation of mercury from water into forage fish on the lower level of the food chain were investigated. Inorganic mercury under high pH values was not as readily translocated from water into fish as under low pH conditions in ambient water. This may be due to unreactive forms of mercury formed under alkaline conditions. (Katz) W75-09904

#### DDT AND PCB LEVELS IN LAKE COEUR D'ALENE, IDAHO, OSPREY EGGS, Idaho Univ., Moscow. Dept. of Biological Sciences.

D. R. Johnson, W. E. Melquist, and G. J. Schroeder.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 4, p 401-405, April 1975. 1 tab, 11 ref.

Descriptors: \*Polychlorinated biphenyls, \*Bird eggs, \*DDT, DDE, Birds, Reproduction, \*Pesticide residues, Environmental effects, DDD, Hatching, Pesticides, Path of pollutants, \*Idaho, \*Pollutant identification.

Identifiers: \*Lake Coeur d'Alene(Idaho), \*Osprey eggs.

Osprey eggs collected from the Coeur d'Alene watershed were analyzed for DDT metabolites and PCB content and shell-thickness. DDE levels ranged from 1.8 to 15 ppm with lesser amounts of DDD and DDT also detected. PCB, probably Aroclor 1260, averaged only 1.2 ppm. Total DDT residues were highest in eggs from clutches which eventually failed. There was no significant difference in shell thickness between sample eggs from clutches which failed and those from clutches which fledged at least one young. (Katz) W75-09907

#### CHLORINATED HYDROCARBONS IN THE LAKE ONTARIO ECOSYSTEM, (IFYGL), Wisconsin Univ., Madison. Water Chemistry Program.

C. L. Haile, G. D. Veith, G. F. Lee, and W. C. Boyle.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 364, \$3.75 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/4-75-022, June 1975. 28 p, 8 tab, 13 ref. EPA IBA 026 R-800608.

Descriptors: \*Lake Ontario, Great Lakes, Ecosystem, \*DDT, \*Chlorinated hydrocarbon pesticides, \*Dieldrin, \*Polychlorinated biphenyls, Biota, Aquatic life, Benthos, Lake sediments, Endrin, Lakes, Sediments, \*Pollutant identification, Gas chromatography.

Identifiers: BHC, Heptachlor.

Lake Ontario fish, water, sediment, net plankton, Cladophora, and benthos were examined for DDT group pesticides, dieldrin, and PCBs. Endrin, BHC group pesticides, and heptachlor were also identified in some fish samples. Average concentration ranged from 28 ng/l (t-DDT), 4.8 ng/l (dieldrin), and 55 ng/l (PCBs) as Aroclor 1254 equivalent for water to 1.40 micro-g/g (t-DDT), 0.07 micro-g/g (dieldrin), and 5.15 micro-g/g (PCBs) for whole fish. DDE levels were generally similar to t-DDT values. PCB/t-DDT ratios averaged 2.6 for all samples except for sediment (7.0) and benthos (5.3). (EPA) W75-10018

#### DETERMINATION OF MOLECULAR HYDROGEN SULFIDE, Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.

T. B. Hoover.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-242 824, \$3.75 in paper copy, \$2.25 in microfiche. En-

vironmental Protection Agency, Report EPA-660/4-75-001, April 1975. 39 p, 11 fig, 6 tab, 27 ref. EPA IBA027.

Descriptors: \*Pollutant identification, Chemical analysis, Hydrogen sulfide, Electrodes, Permeable membranes, \*Electrochemistry, Electrolytes.

Identifiers: Dissolved gas, Molecular hydrogen sulfide, Sparging, Gas-sensing.

The gas sparging technique and a new gas-sensing electrode were evaluated for the determination of dissolved molecular hydrogen sulfide at environmentally significant concentrations in water. From the sparging experiments approximate coefficients were obtained for the distribution of hydrogen sulfide between nitrogen and distilled water, seawater, or municipal sewage effluent. In the latter medium the volatility of hydrogen sulfide was very much less than predicted from the pH-total sulfide relationship. The electrode, consisting of various semipermeable membranes, buffered electrolyte filling solution, silver-silver sulfide crystal sensor, and lanthanum fluoride internal reference electrode, gave a generally Nernstian response to more than 0.1 mg/l of molecular hydrogen sulfide. At lower concentrations the response was typically several tenths of a volt per decade of concentration, but was not reproducible among different samples or electrodes. Various sources of the anomalous behavior were considered. The electrode is recommended for in situ measurements of molecular hydrogen sulfide at concentrations greater than 0.1 mg/l. More work is needed to make it useful at lower concentrations. (EPA) W75-10025

#### AQUEOUS ODOR THRESHOLDS OF ORGANIC POLLUTANTS IN INDUSTRIAL EFFLUENTS, Georgia Univ., Athens. Dept. of Food Science.

D. A. Lillard, and J. J. Powers.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-242 734, \$3.75 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/4-75-002, May 1975. 20 p, 5 tab, 15 ref. EPA IBA027, R-802980-01.

Descriptors: \*Odor, Water analysis, Organic wastes, Statistical methods, \*Pollutant identification, \*Industrial wastes, Effluents, Organic compounds, Air pollution, Organoleptic properties.

Identifiers: Odor thresholds, Extreme value calculations, Triangle test.

Odor thresholds in water were determined for organic pollutants that have been identified in industrial effluents. Seven to fourteen judges were used to determine the odor threshold values of 13 compounds at room temperature and 60C. Odor threshold values for the compounds in ppm at room temperature are: acenaphthene, 0.08; 2-ethyl-1-hexanol, 1.28; butanol, 2.77; geosmin, 0.13 x 10-3; 2-methyl naphthalene, 0.01; 1-methyl naphthalene, 0.02; diacetone alcohol, 44.1; dibenzofuran, 0.12; 2-benzothiazole, 0.08; 2-mercaptothiazole, 1.76; 2-ethyl-4-methyl-1,3-dioxolane, 0.38; caprolactam, 59.7; d-camphor, 1.29. Extreme value calculations were made to predict a concentration below which a certain percentage of the population might still be able to detect the compound(s). The threshold values obtained at 60C in most cases do not differ or are higher than those determined at room temperature. (EPA) W75-10026

#### STUDIES TO DETERMINE METHODS FOR CULTURING THREE FRESHWATER ZOOPLANKTON SPECIES, Fish and Wildlife Service, Yankton, South Dakota, North Central Reservoir Investigations.

D. B. Martin, and J. F. Novotny.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-242

764, \$3.75 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/3-75-010, May 1975. 33 p, 2 fig, 9 tab, 20 ref. EPA IBA021, EPA-IAG-0152(D).

Descriptors: \*Cladocera, \*Copepods, Invertebrates, \*Fish food organisms, \*Zooplankton, \*Cultures, Bioassay, Fresh water, Bioindicators, Standing crops, Harvesting.

Identifiers: \*Bosmina longirostris, \*Chydorus sphaericus, \*Cyclops bicuspidatus thomasi, Test animals.

Studies to determine laboratory methods for culturing unispecific populations of Bosmina longirostris, Chydorus sphaericus and Cyclops bicuspidatus thomasi were carried out. These cultures are to provide a source of animals to be used as live food for fish and as bioassay test organisms. B. longirostris was not successfully cultured. High mortalities, apparently associated with the phenomenon of 'air-locking,' always occurred during handling in the laboratory. C. sphaericus was successfully maintained in relatively dense cultures (approximately 1,000 per liter) using a mixture of dried foods, less than 37 microns in size. One-fourth of the standing crop was harvested each week without apparently reducing the production in the culture. C. bicuspidatus thomasi could be grown using both dried food and live Paramecium multimicronucleatum as an energy source. However, the latter resulted in higher standing drops. Total standing crop as well as the proportion of each life stage in the population fluctuated greatly in the C. bicuspidatus thomasi cultures. Both C. bicuspidatus thomasi and C. sphaericus were grown at 15C, at a light:dark cycle of 12:12 hours, and in a synthetic medium of known chemical composition. C. sphaericus was recommended as being best suited for live fish food and as a bioassay test animal. (EPA) W75-10027

#### ASBESTOS IN DRINKING WATER, Ontario Ministry of the Environment, Toronto. Pollution Control Branch.

G. H. Kay.

Journal of the American Water Works Association, Vol 66, No 9, p 513-514, September, 1974. 4 tab.

Descriptors: \*Public health, \*Asbestos, \*Analytical techniques, \*Potable water, Water sources, Water supply, \*Pollutant identification, Water pollution sources, Foreign research, Filtration, \*Minnesota, \*Canada.

Identifiers: \*Asbestiform fibers, Ontario(Can), Duluth(Minn).

Samples from the water supplies of 22 cities in Ontario, Canada, were assessed for asbestiform fibers. Charts present the asbestos fiber count and estimated mass concentration by distribution-system water and an analysis of the asbestos fiber count. Asbestos is apparently present in all surface waters of inhabited areas of Ontario. After evaluations of known information, the Ontario Ministry of Health advised that at the levels of concentration and size distribution of fibers reported, there was no evidence of an effect on health by the ingestion of asbestos particles. The City of Duluth, Minnesota, also discovered asbestiform fibers in its drinking water. Duluth will probably have to provide treatment, such as filtration, of its drinking water. Research needs to continue on the health hazard that may or may not be present at various levels of asbestiform fibers in drinking water supplies. (Orr-FIRL) W75-10030

#### QUANTITATIVE LARGE-VOLUME SAMPLING TECHNIQUE, Environmental Protection Agency, West Kingston, R. I. Northeast Water Supply Research Lab.

M. A. Levin, J. R. Fischer, and V. J. Cabelli. Applied Microbiology, Vol 28, No 3, p 515-517, September 1974. 2 fig, 2 tab, 8 ref.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Descriptors: \*Analytical techniques, \*Bacteria, \*Filtration, \*Water analysis, Equipment, Laboratory tests, \*Pollutant identification, Filters, \*Sampling.

Identifiers: High-volume sampling, Most probable number.

A filtration technique for high-volume sampling (HVS) in water is described that can be used in combination with the most probable number technique (MPN) for the quantitation of microorganisms present at low densities. The apparatus consists of a Balston type AA cartridge filter, 2.5 by 6.4 cm, with a type 90 filter holder. The filter is made of borosilicate glass microfibers bonded with epoxy resin. It is 98% efficient for 0.3 micromillimeter particles. The HVS technique was used to obtain the MPN estimates of *Salmonella* densities in samples of marine waters around New York City. The HVS technique can be used in any sampling situation as long as a selective-enrichment medium is available for use in combination with the MPN procedure. (Orr-FIRL) W75-10031

#### METHODS FOR THE DETERMINATION OF SPECIFIC ORGANIC POLLUTANTS IN WATER AND WASTE WATER,

National Environmental Research Center, Cincinnati, Ohio. Methods Development and Quality Assurance Research Lab.

J. J. Lichtenberg.

IEEE Transactions on Nuclear Science, Vol NS-22, No 2, p 874-891, April 1975. 13 fig, 57 ref.

Descriptors: \*Monitoring, \*Analytical techniques, \*Pollutant identification, \*Gas chromatography, Spectroscopy, Chromatography, Pesticides, \*Organic wastes, Methodology, Organic compounds.

Methods for sample collection and pretreatment and for isolation and determination of specific organic compounds are reviewed. Methods presented include those designed for the determination of organochlorine, organophosphorus, and organonitrogen pesticides, phenoxy acid herbicides, polychlorinated biphenyls, organic solvents and other selected organic compounds. Gas chromatography is the most widely applicable and popular method for detecting and measuring specific organic compounds in water, waste water, and other environmental media. Gas chromatography used with selective detectors is the most sensitive and selective method for qualitative and quantitative determination of organic compounds that is available. The absolute identification of compounds that can be only tentatively identified by other means is made possible by the recent development and application of the computer-controlled gas chromatograph-mass spectrometer. Examples of the application of infrared, ultraviolet, and fluorescent spectroscopy; liquid chromatography; and thin-layer chromatography for organic analyses are also discussed. (Orr-FIRL) W75-10032

#### A RATIONAL APPROACH FOR PREDICTING THE DISSOLVED OXYGEN PROFILE IN RECEIVING WATERS,

Oklahoma State Univ., Stillwater. School of Civil Engineering.

K. M. Peil, and A. F. Gaudy, Jr.

Biotechnology and Bioengineering, Vol 17, p 69-84, 1975. 9 fig, 14 ref.

Descriptors: \*Analytical techniques, \*Dissolved oxygen, Waste disposal, Streams, Biochemical oxygen demand, Environmental effects, Waste water(Pollution), Biodegradation, Forecasting, \*Pollutant identification, Water pollution sources. Identifiers: Environmental bioengineering, Oxygen uptake curve, BOD curve, Reaeration.

A new method has been developed for predicting the dissolved oxygen profile in a stream receiving

biodegradable wastes. Because the level of dissolved oxygen in a stream influences the health of the aquatic environment, the amount of organic materials removed from waste water should be carefully determined. Such an engineering prediction is among the most complex in the field of environmental bioengineering. For this method the BOD curve is obtained using an open jug technique. The accumulated O<sub>2</sub> uptake curve is then used in numerical integration with physical reaeration data for the receiving stream in order to predict the DO profile in the stream. In this case, 10-liter open jar reactors were utilized to obtain the O<sub>2</sub> uptake curves, and the receiving stream was a 670-liter simulated stream apparatus. A good prediction of the actual DO was obtained. The effect of the reaeration constant K<sub>2</sub> (agitation effect) on the kinetics of O<sub>2</sub> uptake was studied. Increased agitation caused some increase in the BOD curve, with most of the increase coming after the plateau area in the O<sub>2</sub> uptake curve, or after the low point along the DO sag curve. (Prague-FIRL) W75-10034

#### PETROLEUM POLLUTANTS IN SURFACE AND GROUNDWATER AS INDICATED BY THE CARBON-14 ACTIVITY OF DISSOLVED ORGANIC CARBON,

Geological Survey, Reston, Va.

E. C. Spiker, and M. Rubin.

Science, Vol 187, p 61-64, January 10, 1975. 1 tab, 23 ref.

Descriptors: \*Oil pollution, \*Carbon radioisotopes, \*Municipal wastes, Industrial wastes, \*Organic compounds, \*Pollutant identification, Rivers, Groundwater, Surface water, Water pollution sources.

Identifiers: \*Petroleum effluents, C-14, Dissolved organic carbon.

Dissolved organic carbon (DOC) consists of organic compounds such as humic and fulvic acids, herbicides, pesticides, synthetic detergents, phenols, and petroleum hydrocarbons. Once the organic matter decomposes, carbon compounds are altered. While carbon dioxide is recycled, the carbon-14 content of organic carbon is not significantly affected by the synthesis. For this reason, the 14C activity of dissolved organic carbon can be used to distinguish between the two classes of organic carbon—those from petrochemical effluents and those from municipal wastes and agricultural runoff. The industrial wastes are composed of fossil petroleum products which contain no 14C; modern domestic wastes and naturally decaying matter contain approximately the modern atmospheric carbon-14 content. Rivers polluted by petrochemical effluents showed varying amounts of depression of the DOC 14-C activity, which reflects concentrations of 14C-deficient fossil carbon of as much as 40 percent of the total DOC. Studies of six rivers in the eastern United States were consistent with a model; seasonal variations in runoff and stream discharge were considered. (Prague-FIRL) W75-10035

#### IDENTIFICATION OF CRUDE OIL LEAKS AT SEA (IDENTIFICAZIONE DELLA FONTE DI SPANDIMENTI DI PETROLIO GREZZO IN MARE),

A. M. Ilardi.

La Rivista dei Combustibili, Vol 28, No 10, p 367-371, October 1974. 4 fig, 3 tab, 4 ref.

Descriptors: \*Oil spills, Analytical technique, Waste disposal, \*Pollutant identification, Nickel, Oil pollution, Water pollution sources.

Identifiers: Vanadium, Italy.

By ascertaining oil quality, the origin of accidental oil spills may be identified. The composition of crude oil is best analyzed when commonly carried oils are available for comparison. An example of

steps taken to identify two crude oil spills in water is detailed. Gas chromatography of selected distillate fractions from the oil recovered was used. The keys used for identification were quantitative determination of vanadium and nickel from distillation residues. (Prague-FIRL) W75-10036

#### DETERMINATION OF TRACE QUANTITIES OF BORON IN SURFACE WATER BODIES AND IN DRINKING WATER (SPURENBESTIMMUNG VON BOR IN OBERFLÄCHENGEWÄSSERN UND TRINKWASSERN),

V. G. Graffman, P. Kuzel, H. Nosler, and G. Nonnemacher.

Chemiker-Zeitung, Vol 98, No 10, p 499-504, 1974. 1 fig, 3 tab, 20 ref.

Descriptors: \*Boron, \*Water quality, \*Sampling, Potable water, Surface waters, Waste water, \*Pollutant identification, \*Trace elements.

Identifiers: \*Rhine River(Germany).

The boron concentration was determined in about 300 samples of surface water and in about 240 samples of drinking water taken from places distributed throughout the Federal Republic of Germany and West-Berlin. All 110 surface water samples from the river Rhine and samples from most of the other rivers had a boron concentration up to a maximum of 0.25 mg B/liter. Only very small rivers which are known to transport a large amount of waste water showed a significantly higher boron concentration. None of the 240 samples of drinking water had a boron concentration higher than 0.25 mg B/liter. The boron concentrations which were found in surface and drinking water of the Federal Republic of Germany are in the lower range as compared to boron concentrations which have been determined in surface water, ground water and drinking water of other European and non-European countries. (Prague-FIRL) W75-10041

#### A NEW INFRARED INSTRUMENT FOR MONITORING OIL FILMS ON WATER,

Wright and Wright, Inc., Newton Center, Mass.

D. E. Wright, and J. A. Wright.

Marine Technology Society Journal, Vol 9, No 1, p 22-24, January 1975. 4 fig.

Descriptors: \*Oil pollution, \*Monitoring, \*Instrumentation, Oil spills, Oceans, Coasts, Laboratory tests, On-site tests, \*Pollutant identification, \*Infrared radiation.

Identifiers: Oil films, Infrared reflection, Infrared Oil Film Monitor.

A new infrared oil film monitor has been developed to detect oil slicks by remote methods. The technique is based on the infrared reflectance properties of water surfaces at the three-micron spectral region where sharp changes in reflectance occur due to absorption bands. The reflectance of water differs from the reflectance of an oil film with regard to a peak and valley shaped graph for water spectral reflectance, absent with an oil film. Both laboratory and field tests have shown that this instrument can detect oil spills during all weather and lighting conditions. Design changes have improved the Infrared Oil Film Monitor to operate at heights of up to 30 feet above the water level. Slicks which seemed to be oil but by chemical analysis were not were discriminated by the Monitor in both laboratory and field studies. The instrument provides a simple oil/no oil alarm and requires no attendant or cleaning problems. The possible applications of this instrument include: baseline studies of coastal oil slicks; monitoring of petroleum loading/unloading docks for minor spills; detection of oil which might be released into the environment from waste water storage tanks; and monitoring for law enforcement purposes suspected oil dumping or seepage areas. (Prague-FIRL)

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

W75-10044

**ELEVATED TEMPERATURE TECHNIQUE FOR ENUMERATION OF SALMONELLAES IN SEWAGE,**  
Central Public Health Engineering Research Inst., Nagpur (India). Div. of Microbiology.  
For primary bibliographic entry see Field 5D.  
W75-10045

**THE UTILIZATION OF TRACERS IN THE STUDY AND CONTROL OF WATER POLLUTION (UTILIZACAO DE MARCADORES NO ESTUDO E CONTROLE DE POLUICAO DAS AGUAS),**  
For primary bibliographic entry see Field 5B.  
W75-10046

**AN AUTOMATED METHOD FOR DETERMINATION OF RESIDUAL METHANOL IN DENITRIFIED EFFLUENTS,**  
Water Pollution Research Lab., Stevenage (England).  
For primary bibliographic entry see Field 5D.  
W75-10047

**COMPARISON OF AUTOCLAVE AND ETHYLENE OXIDE-STERILIZED MEMBRANE FILTERS USED IN WATER QUALITY STUDIES,**  
Canada Centre for Inland Waters, Burlington (Ontario).  
B. J. Dutka, M. J. Jackson, and J. B. Bell.  
Applied Microbiology, Vol 28, No 3, p 474-480, September 1974. 2 fig, 5 tab, 8 ref.

Descriptors: Water quality control, \*Testing, \*Bacteria, \*Filters, Statistics, Standards, Sampling, Analytical techniques, Toxicity, Filters, E. coli, \*Pollutant identification, \*Water quality standards.

Identifiers: \*Membrane filters, Autoclaves, \*Toxicity tests.

The acceptance of the membrane filter technique as an official method of evaluating water quality forces the microbiologist to decide which membrane filter to choose from a variety of commercially available filters, each with its own brand name and characteristics. Membrane filters manufactured by Gelman, Millipore, and Sartorius were autoclave and ethylene oxide-sterilized and field tested for their recovery of total coliforms, fecal coliforms, fecal streptococci, and heterotrophs. Toxicity studies were performed to determine whether the membranes had a toxic effect on *Escherichia coli* growing at 35 and 44.5°C. The data were analyzed by using split-plot analysis of variance and significance tests. Gelman membrane filters generally produced the highest bacterial counts. Toxicity tests at 35°C showed that Gelman and Millipore autoclaved membrane filters were able to recover 92% of the test organisms. There was an extremely poor recovery rate at 44.5°C. Sartorius membranes were found to have hydrophobic areas which reduced the actual filtering area. The Millipore and Sartorius membranes became distorted and somewhat fragile after autoclaving. The differences observed in the ability of the three brands of membrane filters to recover bacteria make it apparent that the brands can not be used interchangeably and that there should be standardized methods for bacteriological testing of membrane filters. (Orr-FIRL)  
W75-10048

**THE SOURCES AND LEVELS OF MERCURY IN THE SEWAGE OF A UNIVERSITY CAMPUS,**  
Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.  
J. A. Cox, G. L. Lundquist, R. G. Webster, R. A. Cox, and P. C. Lindahl.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 4, p 397-400, April 1975. 1 tab, 9 ref.

Descriptors: \*Mercury, \*Sewage, \*Monitoring, Analytical techniques, Waste water treatment, \*Pollutant identification, Water pollution sources, Illinois.

While it has been assumed that mercury pollution originates from industrial sources, other data have indicated that purely domestic sources may also account for mercury levels in sewage. A University campus in Illinois was chosen for analysis of its sewerage. A three-month survey of the total level of mercury from the main outfall sewer of the central campus was made. From an average of 152 trials, a mercury level of 7.9 ppb greatly exceeded the Illinois Pollution Control Board sewer-discharge criterion. The high levels of mercury slugs originated primarily from laboratories which use mercury and its compounds. A program was then established which identified the mercury users on campus and informed these users of a system where the overall-university and individual-building sewer effluents would be monitored for mercury. A central laboratory was designated for reception and treatment of mercury-containing wastes. Following this program, the mean level of mercury was lowered to 0.83 ppb. Sewage solely from student housing contained mercury only slightly in excess of the established background level. Some slugs of mercury in the main-outfall sewer did not correlate directly to slugs from individual buildings; however, subtle sources of mercury occasionally discharged to sewers are as yet undetermined. (Prague-FIRL)  
W75-10049

**AN EXPERIMENTAL STUDY OF THE DETECTION OF ICE NUCLEI ON MEMBRANE FILTERS AND OTHER SUBSTRATA,**  
National Center for Atmospheric Research, Boulder, Colo.  
For primary bibliographic entry see Field 2B.  
W75-10052

**WATER POLLUTION FROM NONPOINT SOURCES,**  
Midwest Research Inst., Kansas City, Mo.  
For primary bibliographic entry see Field 5C.  
W75-10085

**A PORTABLE GAS CHROMATOGRAPHIC TECHNIQUE TO MEASURE DISSOLVED HYDROCARBONS IN SEA WATER,**  
Nova Univ., Dania, Fla. Physical Oceanographic Lab.  
J. P. Perras.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-786 583, \$4.25 in paper copy, \$2.25 in microfiche. Report No. CG-D-2-75, October 1973. 50 p, 14 fig, 4 tab, 3 ref. DOT-CG-21660-A-3 NEW.

Descriptors: \*Analytical techniques, \*Gas chromatography, \*Oil pollution, Monitoring, Automation, Equipment, Measurement.

Identifiers: Hydrocarbons.

An apparatus and techniques that can be used to determine the presence of alkane hydrocarbons from C-3 to C-6 which are dissolved in an aquatic environment are described. The apparatus is a gas-stripping device which continuously removes hydrocarbon vapors from water and injects them into a gas chromatograph. The gas chromatograph separates and detects the components present in the stripped vapors. Usefulness of this apparatus would be limited in an application to determine the point at which an oil spill is completely removed from the water's surface, because this apparatus depends on the hydrocarbons being dissolved in the water. Once the hydrocarbons are dissolved, they follow the water mass, not the oil on the sur-

face. There is no present knowledge to indicate the exact fate of these volatile hydrocarbons once they become dissolved in the water, but eventually both dilution and volatilization would occur. It would be feasible to install this type of apparatus on appropriate Coast Guard vessels so that surveillance and monitoring could be continuously maintained. In this manner, areas of low level but constant source can be detected even though there is no large, visible oil slick on the water surface. (Jones-Wisconsin)  
W75-10096

**MEASUREMENTS OF ABSOLUTE SCALAR IR-RADIANCE SPECTRA IN RHODE RIVER,**  
Johns Hopkins Univ., Baltimore, Md. McCollum-Pratt Inst.

For primary bibliographic entry see Field 5C.  
W75-10102

**USE OF ALGAE, ESPECIALLY DIATOMS, IN THE ASSESSMENT OF WATER QUALITY,**  
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.  
R. Patrick.

In: 'Biological Methods for the Assessment of Water Quality,' 75th Annual Symposium, American Society for Testing and Materials, ASTM Special Technical Publication 528, 1973, p 76-95. 7 fig, 1 tab, 41 ref.

Descriptors: \*Algae, \*Diatoms, \*Water quality, \*Bioindicators, Biological communities, Pollutants, Pollutant identification, Eutrophication, Plant physiology, Plant morphology, Bioassay, Statistical methods.

Two approaches have been used in determining if algae can reliably indicate water quality. The first is to observe and analyze natural communities; by shifts in species composition and structure of the community, the effect of a pollutant can be estimated. Data for this type of study are accumulated from autoecology and synecology studies. A second approach is to study a single or a few species in cultures in the laboratory under known and carefully regulated conditions. These studies are valuable in determining the physiological and morphological changes in function rates and polymorphism due to the concentration of a chemical or physical factor. Results may be misleading in precisely estimating how a species will behave in streams, lakes, or estuaries, because the species under laboratory conditions may not be subjected to the combinations of stresses or stimulating factors which occur in nature. To continually monitor a water body to determine if anything is inimical to aquatic life, the best way is to use algal community assays. Algal cells integrate all stresses that might deleteriously affect growth and reproduction or, in a similar way, they integrate all stimulants that may be present. (Jones-Wisconsin)  
W75-10112

**COLOR MEASUREMENT METHODS FOR SURFACE WATER RECEIVING COLORED WASTES,**  
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.  
M. W. Corlew.

Available from the National Technical Information Service as PB-243 886, \$4.25, \$2.25 in microfiche. M.S. Thesis, May 1973. 57 p, 11 fig, 7 tab, 42 ref. OWRT A-029-SC(1).

Descriptors: Spectroscopy, \*Photometry, \*Color, Measurement, Textiles, Pulp wastes, \*Methodology, Analytical techniques, Instrumentation, Turbidity, \*Pollutant identification.

Identifiers: \*Color measurement, Textile wastes, Colored waste waters.

A laboratory investigation of methods for measuring color in surface waters with emphasis on

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

developing a routine standard method is reported. The method developed was tested on six river waters which contained colored wastes and on six waste samples diluted in the laboratory. The instrumental method agreed well with the opinions expressed by the panel of observers. Preparation methods for turbidity removal were tested and a standard procedure is suggested.  
W75-10135

**CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1970-SEPTEMBER 1971,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10153

**HYDROLOGIC RECONNAISSANCE OF THE WAH WAH VALLEY DRAINAGE BASIN, MIL-LARD AND BEAVER COUNTIES, UTAH,**  
Geological Survey, Salt Lake City, Utah.  
For primary bibliographic entry see Field 4B.  
W75-10167

**THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN)—SOME QUESTIONS AND ANSWERS,**  
Geological Survey, Reston, Va.  
J. F. Ficke, and R. O. Hawkinson.  
Circular 719, 1975. 23 p, 4 fig, 1 tab, 5 ref.

Descriptors: \*Water quality, \*Streams, \*Network design, \*United States, Data collections, Methodology, Chemical analysis, Water properties, Streamflow, Water yield.

Some of the frequently asked questions are answered concerning concepts used in establishing the National Stream Quality Accounting Network (NASQAN), its purposes, design, value, and future plans. NASQAN is a series of stations at which systematic and continuing measurements are made to determine the quality of the Nation's streams. Design of the network specifies measurement of a broad range of water-quality characteristics which were selected to meet many of the information requests of groups involved in planning and management on a national or regional scale. The primary objectives are (1) to account for the quantity and quality of water moving within and from the United States, (2) to depict areal variability, (3) to detect changes in stream quality, and (4) to lay the groundwork for future assessments of changes in stream quality.  
(Woodared-USGS)  
W75-10168

**ISOTOPE HYDROLOGY 1974—A REVIEW OF THE IAEA SYMPOSIUM ON ISOTOPE TECHNIQUES IN GROUNDWATER HYDROLOGY,**  
Paris-6 Univ. (France). Laboratoire de Géologie Dynamique.  
J. C. Fontes, and P. Fritz.  
International Journal of Applied Radiation and Isotopes, Vol 26, p 1-8, 1975. 1 fig.

Descriptors: \*Radioisotopes, \*Tracers, Flow, \*Groundwater, Aquifers, Model studies, Hydrologic aspects, \*Reviews, Pollutant identification.  
Identifiers: Pollutant flow, Groundwater flow, \*Isotope hydrology.

Highlights of the International Atomic Energy Agency Symposium on Isotope Techniques in Groundwater Hydrology are presented. Discussions dealt with environmental isotopes to be used in the studies of the infiltration process, the origin and flow of groundwater, and geothermal systems. Such methods are useful in predicting flow of pollutants discharged into the ground. Possibilities of using  $^{39}\text{Ar}$  and  $^{85}\text{Kr}$  as research tools are mentioned. The use of artificial radioactive tracers for

studies of aquifer characteristics, and development of models for interpretation of tracer data are also discussed. (Prague-FIRL)  
W75-10172

**ARSENIC IN SEDIMENTS ON THE CONTINENTAL SHELF OF SOUTHEAST AUSTRALIA,**  
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).  
For primary bibliographic entry see Field 5B.  
W75-10177

**THE MAGNETIC FLOWMETER AND ITS USE IN WASTE WATER TECHNOLOGY (DER MAGNETISCHE DURCHFLUSSMESSER UND SEINE ANWENDUNG IN DER ABWASSEN-TECHNIK),**

D. Fieberg.  
Gas-Wasser-Fach Wasser/Abwasser, Vol 115, No 10, p 463-467, October 1974. 8 fig, 5 ref.

Descriptors: Flow, \*Measurement, \*Waste water treatment, \*Biological treatment, \*Flow rates, Liquids, Equipment, Treatment facilities, Instrumentation, \*Pollutant identification.  
Identifiers: \*Magnetic flowmeter.

The advantages and uses of magnetic flowmeters in waste water technology are described. Magnetic flowmeters cause no change in the flow cross-section, and the pressure drop generated by them equals that caused by a pipe of identical length. Magnetic flowmeters can be used reliably for the measurement of viscous liquids and liquids carrying solid materials. The readout is linear and is insensitive to voltage fluctuations up to plus or minus 15%. Magnetic flowmeters are designed for flow rates of up to 10 m/sec, with the lowest range between zero and 1 m/sec. Non-conducting deposits on the pipe walls that could falsify the readout may be removed by ultrason or electric shock. Deposits whose conductivity are the same as that of the medium flowing through do not interfere with the measurements. However, magnetic flowmeters should be used in completely full pipes as partial flow falsifies the readout. Magnetic flowmeters can be efficiently used for the control of the waste water and return sludge in biological waste water treatment plants. (Takacs-FIRL)  
W75-10185

#### A NEW DIRECT ULTRAVIOLET METHOD FOR THE ANALYSIS OF NITRATE IONS,

J. C. Moore.  
Effluent and Water Treatment Journal, Vol 15, No 1, p 17-20, January 1975. 11 fig.

Descriptors: \*Nitrates, \*Nitrification, \*Ultraviolet radiation, Analytical techniques, Ions, Lakes, Waste treatment, Organic compounds, Toxicity, \*Pollutant identification.  
Identifiers: Brucine sulphate analysis, \*Nitrate ions.

A method of direct ultraviolet analysis of nitrate nitrogen is compared with a conventional analysis method which uses brucine sulphate. The brucine sulphate method requires special precautions because of its toxicity, involves precise timing and temperature, and is not accurate in clean water situations because its minimum detectable concentration 0.18 mg/liter for a one cm path length cell at 410 nm. The ultraviolet method is based on the nitrate absorbance maximum at 203 nm. At concentrations of nitrate ions up to 0.5 mg/liter, the two methods performed identically. However, while stream water from lakes produced excellent results by the direct UV method, the brucine sulphate method was not applicable due to lack of sensitivity. Results were also compared for analysis of influent and effluent of a water pollution control center. The plant utilized activated sludge and trickling filters, reduced organic content by 90%, and accomplished nitrification. Both methods produced similar data; accuracy of the

UV method increased with decreasing organic content. Because the direct UV method requires very low organic material, the organic content may be reduced substantially by preliminary precipitation with barium hydroxide and zinc sulphate, improving the applicability of this technique for water analysis. The main disadvantage of the direct UV method had previously been the lack of an inexpensive single beam in instrumentation for use at lower wavelengths. Recently, however, lower wavelengths and a narrower bandpass have become available. (Prague-FIRL)  
W75-10187

#### SOME APPLICATIONS OF THERMAL INFRARED LINESCAN IN WATER RESOURCES STUDIES,

Water Research Association, Marlow (England). N. R. Brereton, and R. A. Downing.  
Water Services, Vol 79, No 949, p 91-96, March 1975. 3 fig, 1 tab, 5 ref.

Descriptors: Groundwater, \*Analytical techniques, Discharge(Water), Surveys, \*Groundwater resources, \*Remote sensing, \*Pollutant identification, Regional analysis, Costs, Infrared radiation.  
Identifiers: \*Thermal infra-red linescan, Groundwater discharge, Pollutant discharge.

The remote sensing method of thermal infra-red linescan has been applied in several regional studies concerned with the large scale development of groundwater resources. These studies were conducted to detect the location of groundwater discharges from the Chalk aquifer into the sea and to assess whether groundwater abstraction from a well field had any effect on vegetation or moisture content of the soil. Sewage outfalls with known temperatures and discharges were used as controls. The method is unlikely to detect spring discharges smaller than 100 liters/s. Groundwater discharges to rivers can be detected if the temperature difference between the surface water and the groundwater is sufficient to create a recognizable thermal anomaly or if groundwater discharge is high enough to not be diluted by the surface water too rapidly. While the thermal infra-red linescan method was not suitable for small or diffuse groundwater flow, the method is most applicable for detection of temperature anomalies in large expanses of water which cannot be economically surveyed from the ground. In coastal surveys, this technique may also be useful for studying the mixing of river and sea waters and for detecting pollution. (Prague-FIRL)  
W75-10188

#### ENERGY EVALUATION AND ORGANIC COMPOUND INDEX IN MUNICIPAL SEWAGE WATER (IN JAPANESE),

For primary bibliographic entry see Field 5D.  
W75-10189

**GLC DETERMINATION OF PPB LEVELS OF CITRATE BY CONVERSION TO BROMOFORM,**  
Pfizer (Chas.) and Co., Inc., Groton, Conn.  
R. G. Bjork.  
Analytical Biochemistry, Vol 63, p 80-86, 1975. 2 fig, 3 tab, 9 ref.

Descriptors: \*Gas chromatography, \*Analytical techniques, Environmental effects, Sewage effluents, Detergents, \*Pollutant identification.  
Identifiers: \*Citrates, Citric acid, Bromoform.

Citrate has been proposed for use as a builder in detergents. For this reason, its biodegradability and potential ecologic impact were evaluated. Citric acid may be determined at the parts per billion level in sewage effluents as well as in natural water bodies by gas chromatography with an EC detector, without prior sample preconcentration. The citrate is converted to bromoform through a

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

pentabromoacetone intermediate. The various Krebs' cycle acids, amino acids, NTA, and citrate chelators were tested for possible interference. Only 3-oxopentanedioic acid, which is stoichiometrically converted to bromoform, interfered. The analytical method developed is useful to measure citric acid concentration as low as 10 parts per billion. (Prague-FIRL)  
W75-10191

**WATER POLLUTION MONITORING SYSTEM, (IN JAPANESE), S. Ikuta.**  
Kankyo Sozo, (Environment Creation), Vol 5, No 1, p 25-30, January, 1975. 3 fig.

Descriptors: \*Monitoring, \*Water pollution, \*Automation, Sampling, Analytical techniques, Mercury, Phenols, Dissolved oxygen, Model studies, \*Pollutant identification, Water quality.

Identifiers: \*Tokyo(Japan), Telemeter system.

A telemeter system to monitor the water quality in public drainages around the Tokyo area is described. Automated continuous monitoring results are reported to a central station from 20 stationary stations and three mobile units. Reported are water temperature, pH, turbidity, electro-conductivity, dissolved oxygen contents, chloride ion, cyanide ion, chromium +6 ion, total mercury, phenol, total organic carbons, sulfur, and oxidation reduction potential. Since the automated analytical techniques for the first six parameters are well established, they are reported by all stations. However the other measurements are selected by individual monitoring stations according to the difficulties in automated operation. The sampling and analysis at any station can be controlled from the central station. Seven additional stations are scheduled to be installed in 1974, and approximately 60 stations intend to participate in the water pollution monitoring system for the Tokyo area. (Katayama-FIRL)  
W75-10196

**EVALUATION OF PHOSPHORUS DYNAMICS IN A WATERSHED,**  
Tri-County Conservancy of the Brandywine, Chadds Ford, Pa. Environmental Programs. For primary bibliographic entry see Field 5B.  
W75-10217

**THE DETERMINATION OF BENZIDINE IN WASTEWATERS,**  
Los Angeles County Sanitation District, Whittier, Calif. San Jose Creek Water Quality Lab. R. L. Jenkins, and R. B. Baird. Bulletin of Environmental Contamination and Toxicology, Vol 13, No 4, p 436-442, April 1975. 2 fig, 8 ref.

Descriptors: \*Waste water treatment, \*Analytical techniques, \*Pollutant identification, Gas chromatography, Colorimetry, Chromatography, Chlorination.  
Identifiers: Carcinogens, \*Benzidine.

Benzidine (4,4'-diaminobiphenyl) has been included on the Occupational Safety and Health Administration's list of chemical carcinogens. Results and observations are reported on the development of analytical procedures for the determination of benzidine in the ppb range in waste waters such as raw sewage, secondary effluents, rivers, and industrial wastes. Waste water samples from the Los Angeles County area were routinely spiked with known amounts of benzidine/methanol standards. The treated samples were then subjected to a sample pretreatment procedure followed by colorimetric, GLC, or TLC analysis. Pretreatment involved adjustment to pH 11, extraction of the filtrate with diethyl ether, extraction of ether phase with 2N HCl, neutralization of acid phase with 10N NaOH, (at this stage colorimetric analysis could be performed), extraction of aqueous phase with diethyl

ether, and concentration of ether phase, (at this stage the GLC and/or TLC analysis can be performed). The GLC analysis is sensitive and selective for benzidine and is preferred over the colorimetric or TLC analysis. The overall detection limit of the analysis is determined by the initial sample size and the volume of the final concentrate. The practical detection limit was in the range of 2-3 micrograms/liter. In unchlorinated waste waters, the experimental spike recoveries ranged between 70-95%. However, low recoveries were realized from chlorinated waste waters spiked with benzidine. The low recoveries are apparently due to the reaction of benzidine with hypochlorous acid to produce a chloramine type structure. The described analytical methods should be suitable for the determination of other carcinogenic anilines in waste waters. (Orr-FIRL)  
W75-10232

**ESTIMATES USING FLUORESCENCE SPECTROSCOPY OF THE PRESENT STATE OF PETROLEUM HYDROCARBON CONTAMINATION IN THE WATER COLUMN OF THE NORTHWEST ATLANTIC OCEAN,**  
Bedford Inst., Dartmouth (Nova Scotia). Marine Ecology Lab.  
D. C. Gordon, Jr., P. D. Keizer, and J. Dale. Marine Chemistry, Vol 2, p 251-261, 1974. 1 fig, 2 tab, 24 ref.

Descriptors: \*Oil pollution, Canada, \*Spectroscopy, Surface waters, \*Atlantic Ocean, Data analysis, Sea water, Sampling, Fluorescence, Organic compounds, \*Pollutant identification. Identifiers: \*Fluorescence spectroscopy.

Recent attention has been given to determining the magnitude and variability of petroleum hydrocarbon concentrations in and on seawater. Sampling was done from cruises in the water column of the northwest Atlantic Ocean between Nova Scotia and Bermuda, Canada. Fluorescence spectroscopy was used to estimate petroleum hydrocarbons concentrations. In surface water (0 to 3 mm) concentrations averaged 20.4 micrograms/liter; in water from 1 to 5 m they averaged 0.8 to 0.4 micrograms/liter. No significant concentrations were detected in deeper water. Variability indicated that distribution of oil in seawater is very patchy, particularly for surface waters. Due to adsorption problems seawater samples for hydrocarbon analysis cannot be collected by conventional sampling methods. The inner surfaces of the samplers must come in contact only with the water being sampled and must be rinsed with organic solvent after samples are removed. For this reason, previous work in the data analysis of seawater hydrocarbons should be re-examined. (Prague-FIRL)  
W75-10233

**SHORTCUT METHODS TEST ALGICIDES,**  
Wisconsin Univ., Madison.  
For primary bibliographic entry see Field 5G.  
W75-10234

**ESTIMATES OF OIL IN AQUATIC SEDIMENTS BY FLUORESCENCE SPECTROSCOPY,**  
Bedford Inst., Dartmouth (Nova Scotia). B. R. Hargrave, and G. A. Phillips. Environmental Pollution, Vol 8, No 3, p 193-215, April 1975. 12 fig, 3 tab, 34 ref.

Descriptors: \*Analytical techniques, \*Pollutant identification, \*Oil wastes, Water pollution sources, Laboratory tests, Fluorescence, \*Spectroscopy, Estimating, \*Sediments, Canada. Identifiers: \*Fluorescence spectroscopy, Nova Scotia, Chedabucto Bay(NS), Bermuda.

Fluorescence spectroscopy has been used to identify petroleum that has been spilled into the water and has become deposited in the sediments. Application of the fluorescence method for estimating oil in water, sediments and organisms

requires that fluorescence be related to a standard. Wavelengths for measurement are chosen by scanning excitation and emission spectra and identifying peaks. Total oil concentrations are not measured, only inferred, and the use of such calibrations assumes that all fluorescence in samples is attributable to the presence of fluorescing compounds equivalent to those in the petroleum standard. A procedure for extracting aromatic containing compounds from sediments was developed in the present study. Fluorescence contour diagrams were constructed and used to compare fluorescence patterns in n-hexane extracts of samples and standard oils. This procedure permits more accurate estimates of total oil concentrations to be made by ensuring that fluorescing compounds observed in sample extracts are derived from petroleum. Similarities in spectral contour diagrams showed the presence of petroleum residues in beach sand from Bermuda, inter-tidal sand and sedimenting material from an inlet near an oil refinery in Nova Scotia, and in sand from Chedabucto Bay contaminated by the ship, Arrow, stranding in 1970. Total oil concentrations ranged from 10-3000 micrograms/gram wet sediment. Fluorescence patterns in many sample extracts did not resemble any standard oil, indicating the presence of material which did not originate from fresh petroleum. (Orr-FIRL)  
W75-10235

**THE INFRARED STUDIES OF SANTA BARBARA CHANNEL OIL SPILL,**  
Cincinnati Univ., Ohio.  
T. Tu-Ching.

Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106, Order No. 74-26,406. Ph.D. Thesis, 1974. 136 p.

Descriptors: \*Oil spills, \*Oil wells, \*California, \*Pollutant identification, \*Infrared radiation, Analytical techniques, Organic compounds, Water pollution effects, \*Path of pollutants. Identifiers: Internal reflection spectroscopy(IRS), Santa Barbara Channel(Calif).

A twelve-month study was carried out to evaluate the effects of a spill from an oil well in Santa Barbara Channel, in southern California, which occurred January 28, 1969. The study evaluated infrared analytical techniques for qualitative identification of different oils and establishment of background levels of hydrocarbon control of marine sediments; studied the movement and deposition of oil both from the spill and from natural seeps in the Santa Barbara Channel; investigated the effect of the size and nature of the sediment on the movement of oil; and correlated the oil movement with sediment formation and movement and natural current patterns. Internal reflection spectroscopy (IRS) was used to analyze 374 samples which had previously been studied by the IR transmission technique. Different mineral composition of sediments was found to complicate the quantitative determination of oil. Conflicting results were discovered in some cases on the composition of sediments by x-ray diffraction methods and by IRS spectra methods; theoretical analysis showed that phosphate was the major constituent of the sediments. In addition, the study of the surface active agent, considered as a pollutant, and its effect on the crystal nature of hydroxyapatite precipitates was presented. (Prague-FIRL)  
W75-10237

**POLLUTION LAB PAYS OFF—TWO WAYS.**  
For primary bibliographic entry see Field 5D.  
W75-10243

**APPLICATIONS OF TOXICITY TESTING TO SEWAGE-TREATMENT PROCESSES,**  
Trent River Authority (England).  
For primary bibliographic entry see Field 5D.  
W75-10244

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

**BIODEGRADATION OF LINEAR ALKYLATE SULFONATES IN RIVER MODEL (IN JAPANESE)**, Chiba Univ. (Japan). Research Inst. for Chemobiodynamics. For primary bibliographic entry see Field 5B. W75-10247

**WATERWAY MONITORING SYSTEM.** For primary bibliographic entry see Field 7A. W75-10248

**FORECASTING WATERSHED POLLUTION USING A MODEL**, Adaptronics, Inc., McLean, Va. A. N. Mucciardi. Water and Sewage Works, Vol 121, No 8, p 58-59, August 1974. 2 fig, 8 ref.

Descriptors: \*Model studies, Watersheds(Basins), Pollutants, Water pollution, Bacteriophage, Coliforms, \*Forecasting, \*Pollutant identification, \*Path of pollutants. Identifiers: \*Adaptive Trainable Network, \*Pollutant forecasting, Non-linear multivariate forecasting model.

A model for forecasting the pollutants in watersheds is explained that overcomes the difficulties experienced with conventional analytical models. The technology in Adaptive Trainable (Learning) Networks places no reliance on prior assumptions; the modeling can provide solutions from a very limited data base; and, the methodology provides accurate forecasts many times farther into the future than previously realized. The Adaptive Trainable Network modeling techniques were used to forecast the total bacteriophage concentration in the Potomac River as a function simply of environmental variables such as river flow rate, river staging, tide levels, precipitation, and average daily temperature. Four ALN forecasting models were constructed: 3-day forecast; 6-day forecast; 9-day forecast; and, 12-day forecast. The networks were able to make forecasts with an average accuracy of 95.2% throughout a 12-day forecasting period. The key to developing non-linear multivariate forecasting models is the ability to train an adaptive learning network model. The ALN modeling procedure not only determines the proper linear and nonlinear structure of the model, but also the relevant or most discriminatory variables are identified. The subset of relevant variables is ranked with respect to discriminatory ability as a byproduct of the ALN training exercise. An explanation of how to develop the model as well as the description of the Potomac River exercise is given. (Orr-FIRL) W75-10249

**ROUTINE SURVEILLANCE ALTERNATIVES FOR WATER QUALITY MANAGEMENT**, Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering. R. C. Ward. Journal Water Pollution Control Federation, Vol 46, No 12, p 2645-2652, December 1974. 18 ref.

Descriptors: \*Pollutant identification, \*Water quality, Management, \*Monitoring, Automation, \*Remote sensing, \*Sampling, Spills, Pollutants, Measurement, Costs, Personnel. Identifiers: \*Automatic monitoring, \*Grab sampling, Data needs, Cost-effectiveness.

Three techniques of routine surveillance for water quality management are reviewed: grab sampling, automatic monitoring, and remote sensing. While grab sampling has been the traditional method of water quality analysis, it has the limitations of being unable to detect rapidly changing water quality conditions, such as spills, and of being unable to identify the source of an extreme. There has also developed a need for data acquisition with a large spatial coverage. The answer in time

coverage is automatic monitoring and in space coverage is remote sensing. For best sampling, all three techniques in combination are needed. Cost, personnel, and data needs are factors to be considered in augmenting a traditional grab sampling system with the other two techniques. Data needs are dependent upon the pollution control strategy used and the character of the stream, both natural and as affected by population and effluent discharges. The cost-effectiveness of each system as applied by Colorado State University for both detection of spills and routine monitoring of pollutants is discussed. Management programs must concentrate on planning for automatic monitoring and remote sensing relative to the needs and the goals of each individual agency. (Prague-FIRL) W75-10250

#### MONITORING THE QUALITY OF SURFACE WATER,

Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands). D. J. Kroon, and M. Q. Mengarelli. Philips Technical Review, Vol 34, No 5/6, p 113-122, 1974. 7 fig.

Descriptors: \*Pollutant identification, Design criteria, \*Surface water, \*Monitoring, Water quality, Automation, Measurement, Eutrophication, Oil spills, Computers, Mathematical models.

The design of a system for monitoring the quality of surface water is described. Ideally a combination of manual and automatic measurements is optimal. Such a system should provide prompt information about a number of simple physical and chemical parameters, relating to oxygen balance and eutrophication, concentrations of malodorous components, mineral oils, oil slicks, phenols, certain trace metals, and organic micropollutants. Monitoring systems in an automatic network may measure only one or two parameters or may measure a large number of parameters. The first type is best situated at discharge sites and at the boundaries of a monitored area for which a mathematical model has been composed. A central computer can then be programmed with this model and immediately warn of unusual pollutants and dangerous situation further downstream. For example, should an oil spill occur, an analysis of floating oil, oil in emulsified form, as well as oil in dissolved form should be measured. Knowledge of the composition of the spill, its sulphur content, and presence of any trace metals (such as vanadium) makes it possible to often establish the origin of such a discharge. In addition, a third type of monitoring station should check the accuracy of the data obtained in measuring water quality. A water monitoring station developed by Philips is detailed, which operates along the river Lambro, near Milan, Italy. (Prague-FIRL) W75-10251

**HOW MUCH 'RELIABILITY' IS 'ENOUGH'**, A. G. Linowiecki, and J. D. Lydick. Offshore, Vol 35, No 2, p 240, 242-244, 247, February, 1975. 4 fig, 1 tab.

Descriptors: \*Pollutant identification, \*Monitoring, \*Costs, Water pollution control, Design criteria, Wells, Mathematical models, Systems, Oil pollution. Identifiers: \*Hydrocarbon pollution.

Costs and reliability of hydrocarbon pollution monitoring are discussed. Subsea well control and monitoring systems should help operators maximize hydrocarbon production with minimum total cost, consistent with safety and pollution control requirements. The methods detailed can be used for various types of equipment and systems and are useful in offshore and subsea applications which involve high costs of lost production and perhaps difficult maintenance. Mathematical relationships are shown for reliability of a pollution control system. The failure rate of a system may

be determined by: design with appropriate stress margins; design verification for the specific application; and employment of proven procedures, trained experienced personnel, and discipline in organization. Control system costs are affected by ability to control the well, ability to provide useful and reliable information about well performance and operating conditions, pollution control capabilities, safety capabilities, and availability. (Prague-FIRL) W75-10254

#### MONITORING: AN ENVIRONMENTAL STATE ESTIMATION PROBLEM

California Univ., Davis. Dept. of Mechanical Engineering.

J. W. Brewer, and S. F. Moore.

Journal of Dynamic Systems, Measurement, and Control, Vol 96, No 3, p 363-365, September, 1974.

1 fig, 1 tab, 12 ref.

Descriptors: \*Design criteria, \*Model studies, \*Monitoring, \*Water quality control, \*Mathematical models, Environmental conditions, Water quality standards, Performance, Regulation, Reliability, \*Pollutant identification. Identifiers: \*Monitoring system design.

A water quality monitoring system is needed by society. These monitors serve as estimators which minimizes the cost of taking measurements and which simultaneously meets constraints on accuracy. The development of a monitor theory will improve environmental technological system design. Monitor synthesis can be divided into two subproblems. The design problem consists of selecting the variables for measurement, selecting the measurement devices, and selecting the spatial distribution of the devices. The management problem consists of choosing, on line, the type and sequencing of measurements. A simulated application of filter theory to the management of a water quality monitor is presented. It is shown that a suboptimal minimum cost monitor can be synthesized by the proper sequencing of costly measurements. However, optimum modeling continues to be a problem of much theoretical interest which requires more investigation. (Orr-FIRL) W75-10255

#### FECAL CONTAMINATION—THE WATER ANALYST'S RESPONSIBILITY PART II

Saint Paul Water Dept., Minn.

M. M. Galvani.

Water and Sewage Works, Vol 122, No 1, 68-70, January, 1975. 1 fig, 42 ref.

Descriptors: \*Analytical techniques, \*Laboratory tests, \*Streptococcus, Sewage bacteria, \*Pollutant identification, Bioindicators, Water analysis, Water pollution sources. Identifiers: \*Fecal contamination.

A simple procedure for the analysis of fecal streptococci to determine their source has been developed. The new media used greatly simplifies the speciation of streptococcus faecalis var. liquefaciens. The procedure with the new media requires less scientific training for accurate results than the most probable number technique which is currently the commonly used method. The media can be easily checked to determine that the results are not from a mixed culture of streptococci. The method of determination does not require highly specialized equipment. (Orr-FIRL) W75-10258

#### TV SYSTEM GIVES AUTOMATIC ALARM AS WESS AS VISUAL MONITORING OF AIR AND WATER POLLUTION

Canadian Controls and Instrumentation, Vol 13, No 9, p 32, September, 1974.

Descriptors: \*Monitoring, \*Pollutant identification, Automation, Effluents, Remote sensing, Data collections, Liquids, Fish.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

Identifiers: \*Television systems.

A television system to give visual monitoring of liquid effluents or stack emissions has been developed by Siemens. The system also provides an automatic alarm of sudden changes. An image is recorded on a compact TV camera and is displayed on a monitor electronically broken down into 3200 dots. Digitized data is sorted and compared with new data, and any discrepancies signal a visual and/or audible alarm. Three adjustable parameters can be set to select the pollution conditions at which an alarm is to be given. These are operating sensitivity, transient disturbance suppression, and sustained disturbance suppression. Monitoring takes place without interruption; operating sensitivity is high enough for a level of alteration of 30% on a coherent surface, corresponding to 0.1% of the television image to be detected. The system can be used for both air and water pollution monitoring. In liquid effluent monitoring, the Telemat system can monitor the degree of cleanliness of the effluent or it can be used with control fish tanks where an alarm occurs when fish die and rise to the tank surface due to their sensitivity to the quantity of the effluent. (Prague-FIRL)  
W75-10263

#### IDENTIFICATION METHOD IN ENVIRONMENTAL SYSTEMS AND ITS APPLICATION TO WATER POLLUTION, Kyoto Univ. (Japan). Dept. of Applied Mathematics and Physics.

S. Ikeda, S. Miyamoto, and Y. Sawaragi.  
International Journal of Systems Science, Vol 5, No 8, p 707-723, 1974. 5 fig, 10 ref.

Descriptors: \*Mathematical models, \*Water pollution sources, Simulation analysis, \*Pollutant identification, Rivers, Streams, Analytical techniques, Equations, \*Path of pollutants.

Identifiers: Fredholm integral equation, Environmental systems.

A non-well posed problem is discussed which arises in the identification of a pollution source distributed along a river from the observed data at the boundary on fixed points. The identification problem for the convective stream, after some transformation, results in solving the Fredholm integral equation of the first kind which is non-well posed. The solution does not continuously depend upon the observed data. The application of a regularization method in numerical analysis, a stable algorithm is obtained to identify the distribution of a pollution source. For the dispersive case, the identification problem is also considered; simulation examples illustrate the applicability of this method to environmental control systems based either on the convective or on the dispersive phenomena. (Prague-FIRL)  
W75-10266

#### INTERRUPTED-SWEEP VOLTAMMETRY FOR THE IDENTIFICATION OF POLYCHLORINATED BIPHENYLS AND NAPHTHALENEs, Montana State Univ., Bozeman. Dept. of Chemistry.

S. O. Farwell, F. A. Beland, and R. D. Geer.  
Analytical Chemistry, Vol 47, No 6, p 895-903, May, 1975. 4 fig, 2 tab, 34 ref.

Descriptors: \*Pollutant identification, \*Analytical techniques, \*Instrumentation, \*Polychlorinated biphenyls, Water pollution sources, Pollutants, Equipment, \*Volumetric analysis.

Identifiers: \*Polychlorinated naphthalenes, Polychlorinated hydrocarbons.

The use of interrupted-sweep voltammetry for the identification of polychlorinated hydrocarbons by characteristic current-voltage patterns and interrupt-potential data was demonstrated. The inexpensive instrumentation developed for this

identification is particularly advantageous in obtaining rapid and reproducible voltammetric data when the chlorinated hydrocarbon reduction waves overlap. The theoretical basis, design, operation, and 'fingerprinting' capability of the equipment are discussed. The several important features of the interrupted-sweep technique that make it especially effective in the fingerprint identification of chlorinated hydrocarbons include: automatic control of the applied waveform by the reduction behavior of the sample; high resolution peaks; and, the relatively low cost of the integrated circuit instrumentation. Characteristic voltammetric fingerprints and reduction potential data were obtained for 31 polychlorinated biphenyls and 37 polychlorinated naphthalenes. Only two of the compounds could not be positively identified using this technique. (Orr-FIRL)  
W75-10268

#### WATER MONITORING IS BIG BUSINESS. Water and Pollution Control, Vol 112, No 9, p 14, September, 1974.

Descriptors: \*Monitoring, \*Water analysis, \*Water quality control, \*Analytical techniques, \*Canada, \*Pollutant identification, Chemical analysis, Sampling, Water sampling.

Monitoring Canada's lakes and rivers in a multi-million dollar proposition. A national network of over 600 fixed sampling stations are operated to assess the state-of-health of lakes and rivers and to show trends in water quality. Samples taken which are considered representative of the entire water system are analyzed for about 90 parameters which are then used to evaluate water quality. Specific tests are conducted to describe important basic conditions such as dissolved oxygen content and pH, indicative of the general health of a particular body of water. Identification and monitoring of trace metals is performed to guard against toxic conditions and effects. Equipment such as the AutoAnalyzer and the atomic absorption spectrophotometer have greatly reduced the time required for an analysis of trace metals. The Canada Centre for Inland Water laboratory is responsible for operating a quality control program to ensure reliability of data and for developing new analytical procedures and techniques. The data from the past ten years of sampling are being interpreted for water quality reports for each province. After the report is finished for a province, bi-annual water quality reports will then be published to inform the public of improvements or setbacks in the aquatic environment. (Orr-FIRL)  
W75-10269

#### RESEARCH ON POLLUTION WITH POLYCHLORINATED BIPHENYLS AND POLYCHLORINATED TERPHENYLS IN SEWAGE PLANTS, (IN JAPANESE), For primary bibliographic entry see Field 5D. W75-10271

#### DEVELOPMENT PROGRESS WITH SALWICO POLLUTION MONITORING SYSTEM. Marine Week, Vol 2, No 5, p 26, January 31, 1975.

Descriptors: \*Oil wastes, \*Oil spills, \*Water pollution control, \*Monitoring, Analytical techniques, Pumps, Equipment, \*Pollutant identification.

Identifiers: Oil density measurement.

An oil pollution monitor has been developed by a Swedish company in order to monitor all normal black and white oils without need for individual setting or calibration. This Salwico monitor, from Salen and Wicander AB, concentrates the oil before scanning it for discoloration and gas evaporation. A rated flow of sample water is fed through a filter band and moved at a constant velocity. The oil density per area unit of the band is thus a direct

function of the oil content in the water. Discoloration of the filter band is measured by a photo cell directly after exposure to the sample water; two signals given are added together, giving a minimum spread between different oils. The equipment is built into one analyzer unit and one control indicator panel. The latter is mounted in a cargo control room while the analyzer contains the wet compartment with pumps and piping, and is either mounted in a small deck cabinet or in the pump casing bulkhead. As pollution control equipment, the monitoring system has now been tested and put into series production. (Prague-FIRL)  
W75-10272

#### ANALYZING ORGANICS IN DILUTE AQUEOUS SOLUTIONS, Oak Ridge National Lab., Tenn.

R. L. Jolley, S. Katz, J. E. Mrochek, W. W. Pitt, Jr., and W. T. Rainey.  
Chemtech, p 312-318, May, 1975. 4 fig, 5 tab, 36 ref.

Descriptors: \*Analytical techniques, \*Organic compounds, \*Domestic wastes, \*Industrial wastes, \*Pollutant identification, Chromatography, Ion exchange, Mass spectrometry, Gas chromatography, \*Organic wastes, Aqueous solutions.

Identifiers: Ultraviolet spectrophotometry.

To evaluate the possible consequences of the discharge of organic compounds from domestic and industrial sewage treatment plants, an integrated, multicomponent analytical procedure for the quantitative determination of organic constituents in the microgram/liter range in complex aqueous solutions has been developed. The method utilizes high resolution chromatography for separation followed by sequential use for identification of ion exchange chromatography, UV spectrophotometry, gas chromatography, and mass spectrometry. The automated high resolution liquid chromatographs were initially developed Oak Ridge National Laboratory. They have been successfully used for separating and detecting over 100 UV absorbing constituents from sewage effluents. In this case, 36 compounds were identified in the primary effluent sample tested; over 70 constituents were partially characterized. Nine compounds were identified in one sample of secondary effluent. (Orr-FIRL)  
W75-10350

### 5B. Sources Of Pollution

#### REVIEW OF LITERATURE PERTINENT TO THE AQUEOUS CONVERSION OF RADIONUCLIDES TO INSOLUBLE SILICATES WITH SELECTED REFERENCES AND BIBLIOGRAPHY (REVISED), Atlantic Richfield Hanford Co., Richland, Wash. For primary bibliographic entry see Field 5D. W75-09892

#### MICROBIOLOGY AND WATER QUALITY IN A TRIBUTARY OF CAYUGA LAKE, Cornell Univ., Ithaca, N.Y. For primary bibliographic entry see Field 5C. W75-09896

#### FINITE ELEMENT MODELING OF FLOW THROUGH POROUS MEDIA, State Univ., of New York, Buffalo. Faculty of Engineering and Applied Sciences. R. T. Cheng.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 750, \$4.75 in paper copy, \$2.25 in microfiche. Dept. of Civil Engineering, Water Resources and Environmental Engineering Research Rept. No. 75-2, March 1975. 87 p, 6 append. OWRT C-4026 (no. 9006) (4).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

Descriptors: \*Aquifers, \*Dispersion, \*Computer models, Simulation analysis, \*Sea water intrusion, Path of pollutants, Interfaces, Groundwater, Porous media, Flow, Computer programs, \*Finite element analysis.

Identifiers: Finite element models.

Findings of an investigation into the application of the finite element method to certain ground water flow problems are presented followed by reproductions of five articles from the published literature originating from the study and an appendix containing a computer subroutine package for solving the convective-dispersion material balance equation using quadratic isoparametric finite elements. The published articles deal with the development of the basic theory for the finite element method as applied to ground water flow as well as basic schemes for application of the method. The results of this development are applied to the problem of sea water encroachment in coastal aquifers, brine movement through causeways, and dispersion of pollutants in ground water flows. The intrinsic generality of the finite element method for solution of the convective-dispersion equation allows the computer program to be applicable to a large class of problems. Only a set of new data which describe the region of interest, discretization, initial and boundary conditions are required to initiate the computations on a fresh problem. The included subroutine package was found to be the most efficient scheme for handling a class of initial-boundary value problems containing both a phreatic surface and a density stratified interface.

W75-09900

#### RADIOACTIVITY FROM SRP OPERATIONS IN A DOWNSTREAM SAVANNAH RIVER SWAMP,

Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

W. L. Marter.

Available from NTIS, Springfield, Va. 22161 as Rept. No. DP-1370, \$5.45 in paper copy, \$2.25 in microfiche. Rept. No. DP-1370, September 1974. 51 p, 16 fig, 15 tab, 3 ref, 3 append.

Descriptors: \*Radioactivity, \*Swamps, Coastal marshes, Deposition(Sediments), Cesium, Cobalt, Strontium, Nuclear reactors, Nuclear wastes, Clays, Flooding, Water pollution, Fish, Regulation, \*South Carolina.

Identifiers: \*Savannah River(SC).

Approximately 25 curies of cesium 137, less than 1 curie of cobalt 60, and trace amounts of strontium 90 were deposited in about two square miles of swamp bordering the Savannah River and adjacent to the southeast Savannah River Plant boundary. Most of the radioactivity was released to on-site streams in the 1960's from reactor area irradiated fuel storage basins. During the period of release, annual average cesium 137 concentration in onsite streams never exceeded 3.0% of the concentration guide of 0.00002 Micro Ci/ml, and concentrations in the Savannah River never exceeded 1% of the guide. Most of the radioactivity in the offsite swamp is associated with kaolin clay particles deposited in the swamp during river flooding which occurred about 23% of the time each year. Gamma exposure rates in the affected area of the off-site swamp range from 30 to 590 mR/year above background. The swamp is uninhabited, and the most likely incremental radiation dose (above background) hunters and fishermen who spend from a few hours to several hundred hours in the swamp would range from less than 1 mR to a few tens of mR per year. No restrictions on use of the swamp are considered warranted nor are remedial actions needed. (Houser-ORNL)

W75-09901

#### A MODEL FOR PREDICTING THE EFFECTS OF SEWAGE EFFLUENT ON WETLAND ECOSYSTEMS,

Michigan Univ., Ann Arbor.

K. R. Dixon.

Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106, Order No. 74-25,187. Ph.D. Thesis, 1974. 120 p.

Descriptors: \*Marshes, \*Ecosystems, \*Mathematical models, \*Sewage disposal, \*Environmental effects, Computers, Simulation models, Nutrients, \*Forecasting, Wetlands, Water pollution sources.

A mathematical model was formulated to forecast the effects of sewage waste water disposal on the ecosystem. The model consists of a set of ordinary, first-order non-linear differential equations which represent the mass balance of the biomass components of the system. The CSMP simulation language is used and operated on a digital computer. Sensitivity analyses for unit variables relating to waste water disposal such as water and nutrients were made. Sensitivity was defined as the percentage change in the unit variable due to a 50 percent change in a parameter during a one-year simulation. For example, of the variables, nutrients have a greater effect on litter decomposition than the amount of water covering the litter. Long-range stability of the model was determined. The model is useful for making decisions about the feasibility of using a particular wetland ecosystem for waste water disposal. Forecasts for an individual marsh ecosystem are possible when data are actually collected from the marsh study area. In this manner, parameters related to added water and nutrients can be varied to give the projected simulation. (Prague-FIRL)

W75-09915

#### A GENERAL LINEAR APPROACH TO STREAM WATER QUALITY MODELING,

IBM Federal Systems Div., Gaithersburg, Md.

M. Arbab, and J. Elzinga.

Water Resources Research, Vol 11, No 2, p 191-196, April 1975. 1 fig, 3 tab, 14 ref.

Descriptors: \*Water quality, \*Dissolved oxygen, \*Mathematical models, Oxygen sag, \*Linear programming, \*Costs, Streams, Analytical techniques, Water quality control, \*Path of pollutants, Model studies.

Identifiers: Pollutant discharge.

Techniques are presented for formulating stream water quality models which attempt to meet dissolved oxygen standards while optimizing some function of individual pollution abatement costs. New properties of the oxygen sag equation allow the constraint set of such mathematical programs to be described to a high degree of accuracy by linear inequalities. With the exception of upper and lower bounds on pollutant discharges, three linear constraints at most are required per reach. With simple constraint elimination techniques, the size of mathematical programs is reduced, making analysis of large-scale stream quality models feasible. For cases where the cost functions are linear or piece-wise linear convex, the analyst may utilize linear programming and its ancillary methods of duality implications, sensitivity analysis, parameterization, chance constraint, and decomposition. For cases where cost functions are not linear or in which variables are discrete, the problem solution may be easier with the presence of linear constraints. (Prague-FIRL)

W75-09917

#### RESEARCH NEEDS AS RELATED TO THE DEVELOPMENT OF SEDIMENT STANDARDS IN RIVERS,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5G.

W75-10013

#### RESIDENTIAL CANALS ALONG THE GULF COAST,

University of Southern Mississippi, Hattiesburg. Dept. of Geology.

O. L. Paulson, Jr., and G. F. Pessoney.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 779, \$3.75 in paper copy, \$2.25 in microfiche. Mississippi Water Resources Research Institute, Mississippi State, Completion Report, July 1975. 40 p, 17 fig, 8 tab, 13 ref. OWRT A-088-MISS(1).

Descriptors: Water pollution sources, Bays, Path of pollutants, \*Canals, Ecology, Water pollution, Gulf of Mexico, \*Mississippi, Dissolved oxygen, Temperature, Salinity, Conductivity, Hydrogen ion concentration, Coliforms, Tides, Dyes, Biochemical oxygen demand.

Identifiers: \*St. Louis Bay(Miss), Canal systems, Flushing rates.

A study of a residential canal system on the Mississippi Gulf Coast and adjacent natural water bodies was conducted to determine the relationship in flushing characteristics between man-made and natural systems. The comparison was based on measurements of temperature, salinity, conductivity, coliform, pH, transparency, biological oxidation demand, dissolved oxygen, bathymetry, tides, water velocity, and Rhodamine dye concentrations. The results indicate that coliforms increase with increasing distance of stations from the receiving water body, St. Louis Bay, and dissolved oxygen decreases in a similar manner. Biological oxidation demand was low at all stations; showing no differences between natural and man-made systems. The canal system studied was shallower than adjacent water bodies and water velocities in the canal system are a function of tidal amplitude while velocities in the river are affected by both tides and runoff. The other parameters measured show little or no differences between natural and man-made systems, but reflect overall seasonal changes. Flushing rates between the residential canal systems and an adjacent natural system are equivalent on the basis of decline in dye concentrations measured over a five day period.

W75-10016

#### MANAGEMENT PRACTICES AFFECTING QUALITY AND QUANTITY OF IRRIGATION RETURN FLOW,

Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.

For primary bibliographic entry see Field 5G.

W75-10019

#### RESEARCH STATUS ON EFFECTS OF LAND APPLICATION OF ANIMAL WASTES,

Kansas State Univ., Manhattan.

W. L. Powers, G. W. Wallingford, and L. S. Murphy.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 472, \$4.75 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/2-75-010, May 1975. 96 p, 5 fig, 13 tab, 233 ref. EPA 1 BB039, R-803021-01-1.

Descriptors: \*Farm wastes, \*Soil disposal fields, Pollution, Runoff, \*Water pollution sources, \*Soil contamination, Soil properties, Land management, \*Path of pollutants.

The primary purpose was to review the literature and analyze research needs on the effects of land application of animal waste. An additional purpose was to assemble published information on application guidelines for animal waste. Included are information on the characteristics of waste, effects of waste on soil and water near application sites, application rates, application techniques, and research needs. The six main topics are: (1), Climate, waste, and soil classification; (2), waste composition; (3), effect of waste on the environ-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

ment; (4) application rates based on waste constituents; (5) application techniques; and (6) research needs. The climate, waste, and soil classification systems were developed to allow comparison of the effects of animal waste applications on land in various parts of the country. The composition of the waste in each climate was tabulated and values compared. Comparisons between climatic regions were not possible because of the large variability within regions. Because of this variability no average composition for a given waste in a given climatic region was possible. The effect of the waste on the environment was measured in terms of the possible final disposition of the waste constituents. These constituents could accumulate in the soil, move to the groundwater, runoff the soil surface, or be taken up by plants. Attempts were made to assemble application guidelines from the various parts of the country. (EPA) W75-10022

#### GROUND WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES, Geraghty and Miller, Port Washington, N.Y. F. van der Leeden, L. A. Cerrillo, and D. W. Miller.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-242 860, \$10.25 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-3-75-018, May 1975. 361 p, 60 fig, 48 tab, 3 append. EPA Program Element 1BA024, 68-03-0298.

Descriptors: \*Groundwater, Mine wastes, Salinity, Septic tanks, \*Water pollution sources, Water quality, Evaluation, Water resources, Waste dumps, Wells, Pacific Northwest U.S., Hardness(Water), Iron, Manganese, Fluorides, Colorado, Montana, Wyoming, \*Waste disposal wells, \*Underground waste disposal.

An evaluation of ground-water pollution problems has been carried out in six states in the northwest: Colorado, Idaho, Montana, Oregon, Washington and Wyoming. With the exception of radioactive waste disposal, few cases of ground-water pollution have been investigated in detail. There is a need for baseline water-quality data and systematic evaluation of overall ground-water conditions, especially in urban zones, in areas of petroleum exploration and development, and at locations of mining and industrial activity. The most common natural ground-water quality problems, other than high salinity, are excessive hardness, iron, manganese, and fluoride. Principal sources of man-caused ground-water quality problems in the approximate order of severity are: discharge of effluent from septic tanks and sewage treatment plants, irrigation return flow, dryland farming, abandoned oil wells, shallow disposal wells, unlined surface impoundments, mine tailings and mine drainage, municipal and industrial landfills, and radioactive waste disposal. Other sources that appear to be of less importance but still must be considered include: spills and leaks, application of fertilizers and pesticides, feedlots, and salt-water intrusion. (Scalf-EPA) W75-10023

#### MEASURING EXTERNAL EFFECTS OF SOLID WASTE MANAGEMENT, Institute for Policy Analysis, La Jolla, Calif.

R. Schmalensee, R. Ramathan, W. Ramm, and D. Smallwood. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 407, \$11.25 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-600/5-75-010, March 1975. 438 p, 28 fig, 34 tab, 7 ref. EPA IDB314, R/T 02 AAE 06, Grant No R-801673.

Descriptors: \*Environmental effects, Property values, \*Landfills, Solid wastes, Economics, Management, Water pollution control, Waste disposal, California.

Identifiers: \*Solid waste management, \*Environmental impact, Los Angeles County(Calif).

This study analyzes the environmental impact of using sanitary landfills for disposing of solid waste. The relevant economic theory concerned with the measurement and valuation of external effects is developed and previous empirical impacts of various activities are reviewed. Both the theoretical and empirical evidence suggests that the costs and benefits of external effects are extremely difficult to measure directly but under certain circumstances property value studies can be used to obtain indirect estimates. A survey of the technology of sanitary landfills suggests that a properly designed fill will cause very little air and water pollution, but may impose visual and noise pollution on nearby residents. These hypotheses are tested with data on property surrounding four sanitary landfills in Los Angeles County. A model of the determinants of residential property values is formulated and estimated. The model includes variables which describe the characteristics of the property and variables which describe the relationship of the property to the fill. Statistical estimates of the parameters of the model indicate that proximity to and view of a sanitary landfill do not significantly reduce the market or assessed value of surrounding property. (EPA) W75-10024

#### THE RESPONSE OF GYMNODINIUM BREVE TO MUNICIPAL WASTE MATERIALS, University of South Florida, Tampa. Dept. of Chemistry.

For primary bibliographic entry see Field 5C. W75-10033

#### A RATIONAL APPROACH FOR PREDICTING THE DISSOLVED OXYGEN PROFILE IN RECEIVING WATERS, Oklahoma State Univ., Stillwater. School of Civil Engineering.

For primary bibliographic entry see Field 5A. W75-10034

#### PETROLEUM POLLUTANTS IN SURFACE AND GROUNDWATER AS INDICATED BY THE CARBON-14 ACTIVITY OF DISSOLVED ORGANIC CARBON, Geological Survey, Reston, Va.

For primary bibliographic entry see Field 5A. W75-10035

#### IDENTIFICATION OF CRUDE OIL LEAKS AT SEA (IDENTIFICAZIONE DELLA FONTE DI SPANDIMENTI DI PETROLIO GREZZO IN MARE),

For primary bibliographic entry see Field 5A. W75-10036

#### GROUNDWATER POLLUTION BY WASTE DISCHARGE (LA POLLUTION DES EAUX SOUTERRAINES PAR LES DECHARGES), M. Barres.

Techniques et Sciences Municipales, Vol 69, No 6, p 365-371, 1974. 2 fig, 3 tab, 22 ref.

Descriptors: \*Groundwater, \*Aquifers, \*Landfills, Flow rates, Waste disposal, \*Water pollution sources.

Identifiers: Waste discharge, Leachout, Sanitary landfills.

The problem of groundwater contamination due to infiltration and leachout from waste dumps and sanitary landfills is discussed, and guidelines for the selection of landfill sites are presented. Waste dumps and sanitary landfills may present a hazard of groundwater contamination by inorganic and organic materials, but very little hazard of biological contamination. Sanitary landfills should be

established in areas protected from inundation and with a low groundwater table level, or where an aquifer has good self-purification possibility. Therefore, porous aquifers are generally more suitable than karstic and fissured rockbed. If the self-purifying capacity of an aquifer is limited, the waste disposal site should be made impervious by applying a layer of clay or plastic film. Also, sites with low groundwater flow rates are preferable. (Takacs-FIRL) W75-10042

#### THE UTILIZATION OF TRACERS IN THE STUDY AND CONTROL OF WATER POLLUTION (UTILIZACAO DE MARCADORES NO ESTUDO E CONTROLE DE POLLUCAO DAS AGUAS), J. Bau.

Laboratorio Nacional de Engenharia Civil, Memoria 446, Lisbon, 1974, p 5-15. 22 ref.

Descriptors: \*Tracers, \*Water pollution sources, Flow, Hydrologic aspects, Analytical techniques, Reviews, Water pollution control, \*Path of pollutants, Dispersion, Pollutant identification.

Identifiers: Chemical tracers, Radioactive tracers, Fluorescent tracers, Pollutant dispersion.

Chemical, radioactive, and fluorescent tracers and their uses in general hydrological and water pollution studies are reviewed. Compounds of chromium, sodium, cobalt, indium, and tantalum are among the most frequently used chemical tracers. The most common radioactive tracers are 82Br, 130I, 192Ir, 182Ta, 51Cr, 198Au, and 110Ag. Fluorescent tracers, such as rhodamine-B, rhodamine-WT, and fluorescein, emit visible light due to the effect of UV irradiation. A literature review of studies and experiments using tracers is presented. Tracers are particularly suitable for the study of flow and dispersion processes in water, as well as the study of the dilution and general behavior of water pollutants. (Takacs-FIRL) W75-10046

#### GROUNDWATER POLLUTION: PROBLEMS AND SOLUTIONS.

Water and Sewage Works, Reference Number 1975, p R125-R126, R130-R132, R134-R136, R138, R140, R142-R144, April 30, 1975. 3 fig, 3 tab, 51 ref.

Descriptors: \*Water pollution, \*Water pollution sources, \*Louisiana, \*Nevada, \*New York, \*Northeast U.S., Groundwater, Biochemical oxygen demand, Water quality, Industrial wastes, Bioindicators, Indicators, Chemicals, Recharge, Basins, Water wells, Infiltration, Rivers, Bacteria, Dissolved solids, \*Path of pollutants.

Identifiers: Industrial indicators.

Included was a general definition of groundwater, its value to society and the imminent dangers it faces. The protection of this valuable resource is vital; hence, indicators of potential polluters were examined and possible methods for preserving the quality of subsurface water were presented. The material for this study was drawn from three geographical regions of the United States and includes specific looks at pertinent problems in Louisiana and Nevada as well as some interesting case histories from the northeast section of the country. Investigations were recommended to study the movement, fate, and effect of pollutants in subsurface waters including to the extent and nature of native microbial activity as well as microbe-pollutant interactions in subsurface regions receiving pollutants. The ultimate objective should be the development of information needed for defining the capacity of subsurface regions as pollutant receptors and, hence, for predicting the probable impact on groundwater of activities entailing the release of pollutants into the earth's crust. (Humphreys-ISWS) W75-10058

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

**MEASUREMENT OF SMALL DISCHARGES THROUGH V-NOTCH WEIRS,**  
Leupold and Stevens, Inc., Beaverton, Oreg.  
For primary bibliographic entry see Field 8B.  
W75-10059

**LABORATORY SIMULATION OF SWINE MANURE LAGOONS,**  
Clemson Univ., S.C. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5D.  
W75-10137

**NUMERICAL MODEL OF THE SALT-WEDGE REACH OF THE DUWAMISH RIVER ESTUARY, KING COUNTY, WASHINGTON,**  
Geological Survey, Tacoma, Wash.  
E. A. Prych, W. L. Haushild, and J. D. Stoner.  
Open-file report 75-13, 1975. 93 p, 29 fig, 13 tab, 53 ref, 2 append.

Descriptors: \*Path of pollutants, \*Estuaries, \*Washington, \*Model studies, Numerical analysis, Saline water intrusion, Sewage effluents, Water temperature, Dissolved oxygen, Biochemical oxygen demand, Phytoplankton, Tracking techniques, Tidal effects, Water pollution sources, Salinity, Chlorophyll.  
Identifiers: \*Duwamish River estuary(Wash).

A numerical model (calibrated and verified with observed data) of a salt-wedge estuary was used to calculate the distributions of salinity, temperature, chlorophyll a concentrations, biochemical oxygen demand, and dissolved-oxygen concentrations in the Duwamish River estuary, King County, Wash. Dissolved-oxygen concentrations were predicted in the estuary when sewage-effluent discharge is increased to its proposed maximum of 223 cubic feet per second. The computed monthly average dissolved-oxygen concentrations in the estuary decreased by a maximum of 2 mg/litre when compared with computations for the summer of 1971, when the effluent discharge averaged 37 cubic feet per second. The increase in effluent discharge is not expected to cause large changes in phytoplankton concentrations in the estuary. (Woodard-USGS)  
W75-10157

**DISTRIBUTION OF NITROGEN AND PHOSPHOROUS IN THE CONSERVATION AREAS IN SOUTH FLORIDA FROM JULY 1972 TO JUNE 1973,**  
Geological Survey, Tallahassee, Fla.  
B. G. Waller.

Available from the National Technical Information Service, Springfield, Va. 22161, as AD-A012347, \$3.25 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 5-75, May 1975. 33 p, 11 fig, 8 tab, 6 ref.

Descriptors: \*Path of pollutants, \*Nitrogen, \*Phosphates, \*Florida, National parks, Nutrients, Water quality, Chemical analysis, Precipitation(Atmospheric), Surface drainage, Mass transfer, Sampling.  
Identifiers: \*Everglades National Park(Fla), Conservation areas.

The term 'Everglades basin' as used in this report extends from Lake Okeechobee in the north, southward through Everglades National Park. It is bordered on the west by the Big Cypress Swamp and on the east by agricultural lands and rapidly expanding urban areas. Within the Everglades basin are three water conservation areas utilized for water storage and recreational use. From July 1972 to June 1973, 78% (5,200 metric tons) of the total nitrogen and 90% (207 metric tons) of the total phosphorus entering the conservation areas was contributed by bulk precipitation (rainfall and dry fallout). Controlled and noncontrolled surface-water discharge contributed the remainder: 22% (1,460 metric tons) of total nitrogen and 10% (22.4

metric tons) of total phosphorus. Of the water lost, 53% was by seepage and 47% by surface-water discharge. About 5,000 metric tons of total nitrogen and nearly 220 metric tons of total phosphorus were apparently retained within the conservation areas. This retention constitutes 74% of the total nitrogen and 96% of the total phosphorus that entered the conservation areas from July 1972 to June 1973. (Woodard-USGS)  
W75-10160

**HYDROLOGIC EVALUATION OF THE HAYSTACK BUTTE AREA WITH EMPHASIS ON POSSIBLE DISCHARGE OF CLASS-I WASTES, EDWARDS AIR FORCE BASE, CALIFORNIA,**  
Geological Survey, Menlo Park, Calif.  
J. L. Huges.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 387, \$3.75 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 7-75, April 1975. 34 p, 4 fig, 4 tab, 11 ref, append.

Descriptors: \*Waste disposal, \*Liquid wastes, \*Solid wastes, \*Underground waste disposal, \*Water quality control, \*California, Injection wells, Fuels, Waste storage, Groundwater movement, Hydrogeology, Arid lands, Hydraulic conductivity, Path of pollutants, Sampling, Hydrologic data, Chemical analysis, Test wells.  
Identifiers: \*Rocket propellant wastes, \*Edwards Air Force Base, Class-I wastes.

Edwards Air Force Base (EAFB), Calif., is northeast of Lancaster in the Mojave Desert. The primary function of EAFB is experimental flight and rocket testing. The Haystack Butte area is used primarily for the testing of rocket propellants. Waste products of the testing are solid and liquid rocket propellants and contaminated soils and metals. In the past these wastes have been containerized, placed in abandoned mine shafts, buried, exploded, or removed from EAFB by civilian contract for disposal in other areas. This report appraises the climatic, geologic, and hydrologic conditions for possible discharge of Class-I wastes, and evaluates the effects of previous disposal of solid and liquid wastes into abandoned mine shafts. Class-I waste disposal sites are those at which complete protection is provided for all time for the quality of ground and surface waters from waste deposited therein and against hazard to public health and wildlife resources. Although usable groundwater does not exist in the area investigated, the groundwater affected by the discharge of Class-I wastes could at some future time affect potentially usable groundwater outside the study area. (Woodard-USGS)  
W75-10161

**LOW-FLOW CHARACTERISTICS OF WISCONSIN STREAMS AT SEWAGE-TREATMENT PLANTS,**  
Geological Survey, Madison, Wis.

W. A. Gebert, and B. K. Holmstrom.  
Water Resources Investigations 45-74, December 1974. 101 p, 2 fig, 32 tab, 34 ref.

Descriptors: \*Low flow, \*Wisconsin, Waste dilution, Waste water disposal, Water pollution, Base flow, Streamflow, Treatment facilities.

Low-flow characteristics of Wisconsin streams at 415 sewage-treatment plants are presented. The low-flow characteristics are the annual minimum 7-day mean flow that occurs on the average of once in 2 years and the annual minimum 7-day mean flow that occurs on the average of once in 10 years. The low-flow characteristics were determined by correlating base-flow measurements at the sewage-treatment plants to the concurrent daily mean flow at continuous-record gaging stations in the area. The accuracy determined by the standard error of estimate for the 10-year low flow ranged from 18 percent at continuous-record gaging

stations to 70 percent when only three base-flow measurements were available. (Knapp-USGS)  
W75-10163

**ISOTOPE HYDROLOGY 1974—A REVIEW OF THE IAEA SYMPOSIUM ON ISOTOPE TECHNIQUES IN GROUNDWATER HYDROLOGY,**  
Paris-6 Univ. (France). Laboratoire de Géologie Dynamique.  
For primary bibliographic entry see Field 5A.  
W75-10172

**ARSENIC IN SEDIMENTS ON THE CONTINENTAL SHELF OF SOUTHEAST AUSTRALIA,**  
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).  
P. J. Davies.  
Search, Vol 5, No 8, p 394-396, August 1974. 1 fig, 2 tab.

Descriptors: \*Arsenic compounds, \*Sediment distribution, \*Municipal wastes, \*Industrial wastes, Sediments, Sedimentology, Sediment-water interfaces, Agricultural runoff, Agricultural chemicals, Water pollution sources, Effluents, \*Australia, \*Continental shelf, Pollutant identification.

Arsenic was discovered in the shelf sediments of southeast Australia as a result of a reconnaissance geological survey conducted during 1972. The arsenic contents in the shelf sediments were up to two orders of magnitude higher than those reported for average shale, sandstone, and limestone. The maximum arsenic concentrations occur offshore from areas of major urban and industrial development, and not offshore from agricultural areas. Support for the suggestion that the arsenic is deposited as the result of urban pollution comes from another study showing the increasing concentrations of arsenic in the Kansas River due to pollution by detergents used in household washing. Arsenic is enriched in the surface sediments of the continental shelf of southeast Australia, particularly between Port Kembla and Newcastle, where concentrations of 50-100 ppm are common. The arsenic may be derived from the natural erosion of rock, or from urban and industrial effluents. The complexing of arsenic with colloidal manganese compounds results in its deposition in the quieter areas of the middle to outer shelf. A series of sediment cores drilled in the areas of high arsenic concentrations could be analysed to determine whether the high arsenic values are due to modern urban/industrial effluents, or related to natural concentration mechanisms coupled with non-sedimentation. (Orr-FIRL)  
W75-10177

**GROUND-WATER'S ROLE IN WATER QUALITY MANAGEMENT,**  
Pennsylvania Dept. of Environmental Resources, Harrisburg. Bureau of Water Quality Management.  
For primary bibliographic entry see Field 5G.  
W75-10180

**DUMPS: A POTENTIAL THREAT TO OUR GROUNDWATER SUPPLIES,**  
Environmental Protection Agency, Washington, D.C. Office of Solid Waste Management Programs.  
B. Weddle, and G. Garland.  
Nation's Cities, Vol 12, No 10, p 21-25, 42, October 1974.

Descriptors: \*Sanitary fill, \*Landfills, \*Waste disposal, \*Groundwater, Wells, Waste dumps, Leachates, Costs, Surface water, Drainage, Planning, \*Water pollution sources.  
Identifiers: Land disposal.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

Sanitary landfill criteria have been reexamined by the Office of Solid Waste Management Programs. Actual damage cases show that groundwater resources are threatened by pollutants leaching from dumps. Two examples were a dump in Connecticut which caused the wells of about 50 subdivision homes to be contaminated, and a more serious case in Delaware in 1972 where a dump in an abandoned sand and gravel pit allowed an underground plume of leachate to envelop one well field of a water company serving 80,000 people. Remedial measures in both cases were costly. The official definition of sanitary landfill includes application of daily cover, no burning, waste not placed directly into groundwater, and no visible pollution of surface water. However, the problem of leachates entering unseeped into groundwater is complex. Leachate forms when water percolating through solid waste flushes out compounds and other products of decomposition. Site characteristics for determining safe sanitary landfill depend upon evaluation of: depth from the bottom of the fill to the maximum height of groundwater; direction and flow rate of groundwater; present and future groundwater demands; analysis of underlying soils and geology including texture, permeability, structure, and stratigraphy; topography related to surface drainage; and net infiltration. Communities should plan for disposal capacity for at least five years into the future. Existing sites should be monitored to avoid costly cleanup measures. (Prague-FIRL)

W75-10184

**WATER POLLUTION MONITORING SYSTEM, (IN JAPANESE),**  
For primary bibliographic entry see Field 5A.  
W75-10196

**DYNAMIC LEACHING STUDIES ON PULP-WOOD BARK RESIDUES,**  
British Columbia Univ., Vancouver. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D.  
W75-10214

**DETERMINISTIC MODEL OF DYNAMIC EUTROPHIC ESTUARY,**  
Air Products and Chemicals, Inc., Allentown, Pa.  
W. R. Schofield, and R. G. Krutchkoff.  
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EE4, Paper No 10735, p 979-996, August 1974. 3 fig, 40 equ, 17 ref.

Descriptors: \*Environmental engineering, \*Estuaries, \*Mathematical models, Eutrophication, \*Stochastic processes, Diffusion, Ecosystems, Water pollution, Optimization, Numerical analysis, Equations, Systems analysis, Model studies.  
Identifiers: \*Deterministic models, Generality, Mass balance, Physical conditions, Biological components, Chemical components.

Previously, a stochastic model of a dynamic, one-dimensional eutrophic estuary was developed; it was shown that this model could be formulated from its deterministic counterpart with the addition of a single new parameter. Herein, the deterministic model upon which the stochastic model was based is developed and explained. The derivation is of sufficient generality to permit any number of components and any reasonable system configuration to be handled. All system parameters, conditions, and forcing function could be continuous functions of time (not just tidal phase), position, and if necessary, other factors. Generalizations have been made in: the differential equations which are solved; the initial and boundary conditions used; the manner in which the physical conditions of cross-sectional areas, light intensities, freshwater flow rate, land runoff, benthal demand, and water temperature, depth, and turbidity are handled; the number of

components considered; and the use of time and position variable parameters and conditions. This deterministic model is more general and realistic than any previous estuary model. Its solution is twice as fast as that for the much simpler BOD-OD model. Recommended are use of the model by operating and design personnel and further verification of both the deterministic and stochastic models. (Bell-Cornell)

W75-10215

#### EVALUATION OF PHOSPHORUS DYNAMICS IN A WATERSHED,

Tri-County Conservancy of the Brandywine, Chadds Ford, Pa. Environmental Programs.  
T. H. Cahill, P. Imperato, and F. H. Verhoff.  
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EE2, Paper No 10445, p 439-458, April 1974. 7 fig, 6 tab, 4 equ, 29 ref.

Descriptors: \*Watersheds(Basins), \*Water quality, \*Environmental engineering, \*Phosphorus, \*Storm runoff, \*Streams, Nutrients, River systems, Equations, Experiments, Measurement, \*Path of pollutants, Water pollution sources.

Identifiers: \*Mass balance.

Phosphorus dynamics in a small river system have been measured to determine phosphorus transport mechanisms and correlation with hydrodynamic phenomena. Variation of chemical forms with flow conditions are related to point and diffuse sources and general equations are derived. Mass balances are developed and diurnal changes are described. Investigation into the phosphate dynamics of the Brandywine River during the summer of 1972 indicates that phosphate transport occurs by two different mechanisms depending upon the type of flow found in the river. For steady flow, phosphate concentrations exhibit the dilution effect. During unsteady stage flow, phosphate concentrations tend to increase with increasing water flow rate. (Bell-Cornell)

W75-10217

#### ESTIMATES OF OIL IN AQUATIC SEDIMENTS BY FLUORESCENCE SPECTROSCOPY,

Bedford Inst., Dartmouth (Nova Scotia).  
For primary bibliographic entry see Field 5A.  
W75-10235

#### THE INFRARED STUDIES OF SANTA BARBARA CHANNEL OIL SPILL,

Cincinnati Univ., Ohio.  
For primary bibliographic entry see Field 5A.  
W75-10237

#### BIODEGRADATION OF LINEAR ALKYLATE SULFONATES IN RIVER MODEL (IN JAPANESE),

Chiba Univ. (Japan). Research Inst. for Chemobiodynamics.  
K. Fujiwara, T. Sugiyama, K. Koike, and K. Oba.  
Nippon Eisei gaku Zasshi, (Japanese Journal of Hygiene), Vol 29, No 6, p 552-557, February 1975. 6 fig, 4 tab, 14 ref.

Descriptors: \*Biodegradation, \*Model studies, \*Organic compounds, \*Linear alkylate sulfonates, Rivers, Surfactants, Detergents, Water pollution sources, \*Path of pollutants, \*Pollutant identification.

Identifiers: Methylene blue, Ultraviolet spectrophotometry.

A river model for measuring the biodegradability of organic materials has been developed which simulates the natural aquatic environments. By using this model, the biodegradability of linear alkylate sulfonates (LAS) was determined by using methylene blue and UV spectrophotometry to detect the presence of LAS. LAS which was added to produce a concentration of 10 ppm was shown

to be removed almost completely in twenty days from the water fractions and bottom sludge layers by determination with methylene blue. The UV spectrophotometry revealed a residue of about 40% in water fractions and about 25% in the bottom sludge layers even after the 20 day period. The discrepancy of these biodegradabilities might be due to the difference between the principles of the determination methods. The rate of biodegradation of LAS compounds containing alkyl chains in the range from C10 to C14 was fastest in compounds containing the C14 chains and slowest in the compounds containing C10 chains. LAS compounds having phenyl radicals near the terminal part of the alkyl chains could be decomposed easily. However, when the phenyl radicals were bound to the inner part of the chains it was more difficult to attack them. (Orr-FIRL)

W75-10247

#### FORECASTING WATERSHED POLLUTION USING A MODEL,

Adaptronics, Inc., McLean, Va.  
For primary bibliographic entry see Field 5A.  
W75-10249

#### WATER QUALITY ROUTING OF UNSTEADY RIVER FLOW BY FINITE ELEMENT METHOD,

Osaka Univ. (Japan). Dept. of Civil Engineering.  
K. Muraoka, and K. Nakatsuji.  
Osaka Daigaku Kogakko Hokoku (Technology Reports of the Osaka University), Vol 24, No 1191-1129, p 827-845, October 1974. 9 fig, 10 ref.

Descriptors: \*Discharge(Water), \*Mathematical models, \*River flow, \*Unsteady flow, Flood routing, Hydraulics, Simulation analysis, Fourier analysis, Finite element analysis, Water quality, \*Path of pollutants.

Identifiers: \*Water quality routing, Diffusion-convection equation, Galerkin method.

For the optimal management of waste discharge facilities, it is necessary to establish mathematical modeling of water quality routing of unsteady river flow. While flood routing and numerical analyses have been conducted, a large amount of error is introduced, particularly due to pseudo-dispersion caused by large space gradients of hydraulic quantities. In this case, the applicability of the Galerkin method is demonstrated. The method is based on finite element weighted residual methods and simulates a water quality problem using a diffusion-convection equation. Numerical errors are evaluated by means of an amplification factor as defined by Fourier analysis and are compared with those of several other finite difference methods. Computational efficiency of the Galerkin method is discussed, and application to a two-dimensional ideal model is considered. (Prague-FIRL)

W75-10252

#### FECAL CONTAMINATION—THE WATER ANALYST'S RESPONSIBILITY PART II,

Saint Paul Water Dept., Minn.

For primary bibliographic entry see Field 5A.

W75-10258

#### IDENTIFICATION METHOD IN ENVIRONMENTAL SYSTEMS AND ITS APPLICATION TO WATER POLLUTION,

Kyoto Univ. (Japan). Dept. of Applied Mathematics and Physics.

For primary bibliographic entry see Field 5A.

W75-10266

## SC. Effects Of Pollution

#### BENEFICIAL USES OF WASTE HEAT,

International Atomic Energy Agency, Vienna (Austria).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

For primary bibliographic entry see Field 5G.  
W75-09889

#### HUMAN RADIATION DOSE STUDIES. A SELECTED BIBLIOGRAPHY.

Technical Information Center (AEC), Oak Ridge, Tenn.

For primary bibliographic entry see Field 5A.  
W75-09890

#### TERRESTRIAL AND FRESHWATER RADIATION ECOLOGY, A SELECTED BIBLIOGRAPHY.

Washington State Univ., Pullman. Dept. of Zoology.

For primary bibliographic entry see Field 5A.  
W75-09891

#### MICROBIOLOGY AND WATER QUALITY IN A TRIBUTARY OF CAYUGA LAKE,

Cornell Univ., Ithaca, N.Y.

M. Khare, C. Thomas, and N. Dondero.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 759, \$9.25 in paper copy, \$2.25 in microfiche. Cornell University Water Resources and Marine Sciences Center, Ithaca, N.Y. OWRT A-030-NY(1). 14-31-0001-3232, 3532, 4032, 5032.

Descriptors: \*Water pollution control, \*Water quality, Streams, \*Wastes, \*Feedlots, Effects, Cattle, Lakes, Watersheds(Basins), Sampling, Chemical wastes, Biochemical oxygen demand, Dissolved oxygen, Bacteria, Nitrogen, Phosphate, Coliforms, Surface waters, \*Microbiology, \*New York.

Identifiers: \*Cayuga Lake(NY), \*Taughannock Creek(NY).

The effects of a cattle feedlot as a source of water pollution on Taughannock Creek, a Tributary of Cayuga Lake, were studied in terms of several common chemical parameters and in terms of most probable numbers of coliforms, fecal coliforms, fecal streptococci, denitrifiers, nitrifiers, and total plate counts. Data were highly variable, but the feedlot clearly contributed to pollution of the stream, although concentrations did not indicate severe pollution conditions. The feedlot contributed significant amounts of nitrogen and phosphate to the stream system and potentially to Cayuga Lake. Additional nitrogen probably originated from soils and groundwater in the drainage basin. Coliform, fecal coliform, and fecal streptococcus levels were conspicuously high at the feedlot. Although the concentrations of fecal coliforms and fecal streptococci quickly subsided and were low at the mouth of Taughannock Creek, the constant presence of *Salmonella* supported their utility as indicators of sanitary quality of surface waters. Many of the bacteria were transients, entering the water at the feedlot and disappearing downstream.  
W75-09896

#### THE EFFECTS OF ARTIFICIAL DestrATIFICATION ON THE WATER QUALITY AND MICROBIAL POPULATIONS OF HYRUM RESERVOIR,

Utah Center for Water Resources Research, Logan.

D. D. Drury, D. B. Porcella, and R. A. Gearheart. Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 722, \$7.00 in paper copy, \$2.25 in microfiche. Utah Water Research Laboratory, Publication No. PR-JEWO11-1, 174 p, 66 fig, 9 tab, 5 append. OWRT A-020-UTAH(1). 14-31-0001-4045.

Descriptors: \*Destratification, Aeration, Algae, Bacteria, Thermocline, \*Nutrients, Carbon, Phosphorus, Nitrogen, Oxygen, Temperature, Flow, Residence time, Lakes, \*Utah, Trout, Dissolved oxygen, Eutrophication, Distribution,

Water pollution effects, Water quality; Microbiology.  
Identifiers: \*Hyrum Reservoir(Utah), \*Algal-bacterial dynamics, Little Bear River(Utah), \*Aphanizomenon, Microbial populations.

Hyrum Reservoir, Utah, was studied for one year and then for a year following the initiation of artificial destratification. The redistribution of dissolved oxygen to the lower depths of the reservoir significantly increased the amount of habitat suitable for trout. The annual *Aphanizomenon* bloom increased during that first year after initiating destratification. The nitrogen cycle and the vertical distribution of bacteria were altered as a result of the elimination of the thermocline. During destratification the total suspended solids were correlated with the total coliforms. The water quality of Hyrum Reservoir was highly affected by annual runoff, spring and fall overturns, and destratification; sediments, the increased *Aphanizomenon* bloom, higher euphotic nutrient concentrations, more uniform microbial and nutrient distributions all resulted from these hydraulic factors working singly and in combination.  
W75-09897

#### FAUNAL RESPONSE TO SPRAY IRRIGATION OF CHLORINATED SEWAGE EFFLUENT,

Pennsylvania State Univ., University Park. School of Forest Resources.

For primary bibliographic entry see Field 5D.  
W75-09899

#### PHthalate ESTERS, HEARTRATE DEPRESSORS IN THE GOLDFISH,

Oak Ridge National Lab., Tenn.

P. Pfuderer, and A. A. Francis.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 3, p 275-279, March 1975. 2 tab, 13 ref.

Descriptors: Wastes, \*Fish physiology, \*Bioassay, \*Inhibitors, Mode of action, Path of pollutants, Food chains, Reproduction, Growth rates, Public health, Water pollution effects.

Identifiers: \*Phthalate esters, \*Dibutyl phthalate, \*Heartrate depressors, \*Goldfish.

Phthalate esters, an additive in polyvinyl chloride manufacture, were isolated as heartrate depressors in goldfish. Three compounds were identified and the most active was dibutyl phthalate, probably because it was the most water soluble of the three. Heartrate returned to resting levels when the fish were put through two or more changes of fresh water. The phthalate esters probably affect the heartrate indirectly through the nervous systems. (Katz)  
W75-09902

#### EFFECT OF ASULAM IN WILDLIFE SPECIES: ACUTE TOXICITY TO BIRDS AND FISH,

May and Baker Ltd., Dagenham (England).

B. Ingham, and M. A. Gallo.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 2, p 194-199, February 1975. 6 tab, 7 ref.

Descriptors: \*Herbicides, \*Bioassay, \*Toxicity, \*Rainbow trout, \*Channel catfish, \*Pesticides, Birds, Mallard duck, Sunfishes, Laboratory tests, DDT, Water pollution effects, Pollutant identification.

Identifiers: \*Asulam, Partridges, *Carassius auratus*, *Lepomis macrochirus*, Pheasants.

The results of the acute toxicity experiments conducted to determine the hazard of asulam, a herbicide, to wildlife species are presented. Results of acute toxicity experiments indicate a low order of toxicity resulting from massive doses of asulam given by gavage, in the diet or in bath waters to rainbow trout, channel catfish, bluegill, mallard

duck, pheasants and other test organisms. It was concluded that asulam presents a very low potential for hazard to wildlife in treated areas. (Katz)  
W75-09903

#### IMPORTANCE OF WATER PH IN ACCUMULATION OF INORGANIC MERCURY IN FISH,

Wisconsin Univ., Madison. Dept. of Entomology.

For primary bibliographic entry see Field 5A.  
W75-09904

#### EFFECTS OF PCB (AROCLOL 1254) AND P, P' DDT ON PRODUCTION AND SURVIVAL OF DAPHNIA MAGNA STRAUSS,

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

A. W. Maki, and H. E. Johnson.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 4, p 412-416, April 1975. 1 tab, 1 fig, 13 ref.

Descriptors: \*Daphnia, \*Toxicity, \*DDT, \*Bioassay, \*Reproduction, \*Polychlorinated biphenyls, \*Aroclor, Bioindicators, Environmental effects, Toxicants, Chlorinated hydrocarbon pesticides, Laboratory tests, Analytical techniques, Lethal limit, Inhibition.

Identifiers: \*Daphnia magna, Additive effects, LC50.

The combined and individual effects of DDT and Aroclor 1254 on the survival and reproduction of *Daphnia magna* were examined in laboratory toxicity tests. *Daphnia magna* was an indicator of the toxicity of both DDT and PCB as measured by static toxicity tests. The 14-day LC50's were 0.67 ppb and 24.0 ppb respectively with effective values for reproductive inhibition as low as 0.30 ppb for DDT and 10.0 ppb for Aroclor 1254. The toxicants were found to work together but their combined effect was slightly less than predicted by simple additive toxicity. (Katz)  
W75-09905

#### THE EFFECT OF METHYL MERCURY ON GILL METABOLISM AND BLOOD PARAMETERS OF RAINBOW TROUT,

Michigan State Univ., East Lansing.

D. V. O'Conner, and P. O. Fromm.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 4, p 406-411, April, 1975. 2 tab, 15 ref.

Descriptors: \*Mercury, \*Bioassay, \*Fish physiology, \*Metabolism, \*Electrolytes, \*Oxygen, \*Rainbow trout, Water pollution effects, Laboratory tests, Metals.

Identifiers: Gills, Sublethal effects, Plasma.

Methyl mercury has been shown to accumulate in gill tissue up to several thousand times the level found in the media. The effects of methyl mercury on the metabolism or physiological function (plasma electrolyte regulation) of the gill were investigated. Rainbow trout were used in the bioassay and results indicate that up to 12 weeks exposure to methyl mercuric chloride (10 micro g Hg/liter) does not affect the in vitro metabolism of the gill or concentration of plasma electrolytes in rainbow trout. The only deleterious effect exhibited by fish was a significant increase in hematocrit after 12-weeks exposure. There is a need to consider the effects of long-term exposure to methyl mercury. (Katz)  
W75-09906

#### DDT AND PCB LEVELS IN LAKE COEUR D'ALENE, IDAHO, OSPREY EGGS,

Idaho Univ., Moscow. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5A.  
W75-09907

## Effects Of Pollution—Group 5C

TOXAPHENE INHIBITION OF ATPASE ACTIVITY IN CATFISH, *ICHALURUS PUNCTATUS*, TISSUES, Mississippi State Univ., Mississippi State. Dept. of Biochemistry.

D. Desaiyah, and R. B. Koch.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 2, p 238-244, February 1975. 3 tab, 12 ref.

Descriptors: \*Enzymes, \*Inhibitors, Mode of action, \*Inhibition, \*Pesticides, \*Channel catfish, \*Toxicants, Analytical techniques, Metabolism, Chlorinated Hydrocarbon pesticides.

Identifiers: \*ATPase, \*Toxaphene, \*Tissue analysis.

The inhibition pattern of toxaphene in different tissues of the channel catfish was examined in order to understand the mode of action of this pesticide used in the control of cotton pests. ATPase activities of the brain, kidney and gill tissues were inhibited by toxaphene, with variations between tissues and within the same tissue. The greatest inhibition occurred for oligomycin-insensitive  $Mg^{2+}$  ATPase in brain and gill tissues. The differential sensitivity of ATPases to toxaphene could be due to the fact that toxaphene is a mixture of 175 components and each may exert different effects on the various ATPase activities. (Katz)

W75-09908

## TOXICITY OF DFP AND RELATED COMPOUNDS TO SQUIDS IN RELATION TO CHOLINESTERASE INHIBITION AND DETOXIFYING ENZYME LEVELS, Vanderbilt Univ., Nashville, Tenn. Dept. of Pharmacology.

W. D. Dettbarn, and F. C. G. Hoskin.

Bulletin of Environmental Contamination and Toxicology, Vol 13, No 2, p 133-140, February 1975. 2 tab, 17 ref.

Descriptors: \*Enzymes, \*Inhibitors, \*Toxicants, Waste disposal, \*Bioassay, \*Toxicity, \*Animal physiology, Inhibition.

Identifiers: \*Acetylcholinesterase, \*DFP, \*Nerve-gas, \*Squids, \*Cephalopods, Paraoxon.

The toxicity of DFP and some related acetylcholinesterase-inhibitors were determined using squids. DFP was much less toxic to squid than to mammals, and less toxic to squids than were 217AO, Paraoxon, or physostigmine. This is probably due to the high level of DFPase in the squid nervous system. From the nature of the squid-nerve-type DFPase, it may be speculated that the nerve gases Tabun, Sarin and Soman would be somewhat more toxic to squids than was DFP. (Katz)

W75-09909

## THE GEOCHEMICAL AND BIOSTRATIGRAPHIC RECORD OF NATURAL AND POLLUTIONAL EUTROPHICATION OF MINNESOTA LAKES, Minnesota Univ., Minneapolis. Dept. of Botany.

E. Gorham, and H. E. Wright, Jr.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 774, \$3.25 in paper copy, \$2.25 in microfiche. Water Resources Research Center, University of Minnesota, St. Paul, July 1975. Completion report, 12 p, 10 ref. OWRT B-081-MININ(1).

Descriptors: \*Ecology, \*Pigments, \*Diatoms, \*Cladocera, Carotenoids, Chlorophyll, Erosion, \*Eutrophication, \*Geochemistry, History, Lakes, \*Minnesota, Sediments, Weathering, Pollution, Limnology, \*Lake sediments, Water pollution effects, Detritus.

Identifiers: Paleoecology, Natural eutrophication.

Pigment analysis of profundal surface sediments in Minnesota lakes has demonstrated that sedi-

mentary organic matter derives mainly from detritus produced within the lakes. Only in the most oligotrophic and unproductive lakes are terrestrial inputs to sedimentary organic matter likely to be considerable. Rising concentrations of fossil pigments in sedimentary organic matter, which are easily and quickly measured, offer a clear stratigraphic indication of the onset of cultural eutrophication. The time of onset can then be determined by other techniques such as pollen analysis, radio-isotope dating, etc. A record has been obtained of the degree of leaching and of erosion in postglacial times at Kirchner Marsh, the site of intensive paleoecological studies by several investigators. Periods of low erosion are indicated by low concentrations of Na, K, and Mg in the lake sediments and correlate generally with periods of high lake productivity. Carbonates disappeared from the sediments about 5,000 years ago. Stratigraphic analyses of short cores of lake sediments show a distinct change in diatom flora, which can be correlated with known historic disturbances in the watershed or the lake, such as waste disposal, agricultural land clearance, and logging. When the nature and the magnitude of the changes can be identified by this technique, it will be possible to predict lake-restoration projects. (Waelti-Minnesota) W75-10010

BIOCHEMICAL AND NUTRITIONAL INTERACTIONS BETWEEN THE OYSTER (*CRASSOSTERA VIRGINICA* (GMELIN)) AND ITS ENVIRONMENT, Maryland Univ., College Park. Dept. of Chemistry.

M. Keeney.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 775, \$3.25 in paper copy, \$2.25 in microfiche. Maryland Water Resources Research Center, College Park, Technical Report No 32, June 1975, 5 p. OWRT B-018-MD(1) 14-31-0001-4090.

Descriptors: \*Oyster, \*Enzymes, \*Metabolism, \*Heavy metals, \*Cadmium, Nutrients, Biochemistry, \*Adsorption, \*Estuarine environment, Toxicity, \*Lethal limit, Water pollution effects, Jelly fish, Phosphates.

Identifiers: Phosphoenolpyruvate carboxykinase, Diphosphoinositides, Phosphatases.

The purpose was to obtain information on the biochemical and nutritional interactions between estuarine organisms and their environment in order to understand the effects of heavy metal uptake on these animals. A Ph.D. thesis on enzyme activity of phosphoenolpyruvate carboxykinase in the cytoplasm of the oyster has been completed. This enzyme may be involved in glycogen synthesis in the oyster. A M.S. thesis on diphosphoinositides in oyster lipid has also been completed. A study of acute toxicity levels of cadmium in water has indicated that the toxic level is between 0.1 and 0.25 ppm for oysters as measured by shell growth under laboratory conditions. A paper on phosphatases in the jellyfish has been published. Both acid phosphatases and alkaline phosphatases show similarities to vertebrate enzymes. (W75-10011)

## EFFECTS OF ORIGINAL VEGETATION ON RESERVOIR WATER QUALITY, Texas A and M Univ., College Station. Water Resources Inst.

J. Ball, C. Weldon, and B. Crocker.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 777, \$5.75 in paper copy, \$2.25 in microfiche. Technical Report No TR-64, April, 1975. 120 p, 54 fig, 18 tab, 2 append, 18 ref. OWRT A-025-TEX(1), 14-31-0001-3844, 14-31-0001-4044, 14-31-0001-5044.

Descriptors: \*Nutrients, \*Vegetation, \*Leaching, Grasses, Trees, Reservoirs, Water quality, \*Texas, \*Nitrogen, \*Phosphorus, \*Land clearing.

\*Pre-impoundment, Reservoir sites, Water pollution effects.

Identifiers: \*Reservoir water quality, Reservoir clearing policy, Palmetto Bend Project(Tex), Herbage.

Leaching studies were conducted on representative grasses, herbage and trees to determine the relative nutrient release rates of nitrogen and phosphorus. In addition, a limited field study was conducted as well as a vegetation inventory at a proposed Bureau of Reclamation reservoir, site near Edna, Texas. The results of the leaching study were presented as percent nutrients released from the various types of vegetation as a function of time. The total quantity and rate of nutrient release varied greatly depending upon the type of vegetation. An example, grasses and herbage (1) release nutrients at a greater rate, (2) contain a greater quantity of nutrients per unit weight of vegetation and generally are more available in greater quantities based on weight per unit area than trees. This indicated that although trees are often the only vegetation removed from a reservoir site, the amount of nutrients available for release by the herbage and grasses will probably have a much more significant impact on reservoir water quality and should be considered in the reservoir clearing policy. Several recommendations were made including a methodology for predicting the effects of original vegetation on reservoir water quality for any specific project. W75-10014

## CHLORINATED HYDROCARBONS IN THE LAKE ONTARIO ECOSYSTEM, (IFYGL), Wisconsin Univ., Madison. Water Chemistry Program.

For primary bibliographic entry see Field 5A. W75-10018

## TEMPERATURE EFFECTS ON EGGS AND FRY OF PERCOID FISHES, Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.

L. L. Smith, Jr., and W. M. Koenst.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-242 746, \$5.25 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/3-75-017, May 1975. 91 p, 9 fig, 16 tab, 33 ref, 2 append. EPA 1BA021, R-800704.

Descriptors: \*Sauger, \*Walleye, \*Environmental effects, \*Growth rates, \*Fish eggs, \*Fish larvae, Juvenile fishes, Growth stages, Water pollution effects, Cold resistance, Heat resistance, Water pollution effects, Thermal pollution, Lethal limit.

Identifiers: Temperature tolerance, Acclimation, Percoid fishes.

Temperature effects on the early life history stages of the walleye (*Stizostedion vitreum vitreum* (Mitchill)) and sauger (*Stizostedion canadense* (Smith)) were examined. Walleye eggs and fry were exposed to six temperatures (6-21C) for effects on fertilization, incubation, and fry survival. Mature sauger were held and eggs were fertilized at four temperatures (9-18C). Both species were incubated at 6-21C. Sauger fry survival was also tested at 6-21C. Optimum fertilization temperatures were 6-12C for walleye and 9-15C for sauger. Optimum incubation temperatures were 12-15C for both walleye and sauger. A sharp drop or rise in temperature had no great effect on walleye fry and juvenile survival except when the upper lethal or lower lethal temperature was approached. Optimum temperature for juvenile walleye and sauger growth was 22C. Upper lethal temperatures for walleye juveniles were determined for acclimation temperatures at 2C intervals between 8-26C. The upper lethal temperature for walleye juveniles was 27.0-31.6C, depending on acclimation. The upper lethal temperature of sauger acclimated to 10-26C was 26.6-30.4C. There was little temperature difference (1-2C) between 100% survival and no survival. (EPA)

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

W75-10020

#### TOXICITY OF SELECTED PESTICIDES TO THE BAY MUSSEL (*MYTILUS EDULIS*),

Stanford Research Inst., Menlo Park, Calif.

D. H. W. Liu, and J. M. Lee.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-243 221, \$5.25 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/3-75-016, May 1975. 102 p., 8 fig., 30 tab., 36 ref., 3 append. EPA Program Element 1BA022, 68-01-0190.

Descriptors: Water pollution effects, \*Pesticide toxicity, \*Mussels, Mollusks, Marine animals, \*Insecticides, \*Herbicides, 2,4-D, Growth stages, \*Embryonic growth stage, \*Larval growth stage.

Identifiers: Sevin, Treflan, Methoxychlor, Malathion.

The toxicity of the insecticides Sevin, methoxychlor, and malathion and of the herbicides Treflan and 2,4-D to the bay mussel (*Mytilus edulis*) was investigated. Toxic effects were measured in terms of survival of and byssus-thread attachment by adults, embryoshell development, and larval growth and metamorphosis. Growth was the most sensitive measure of toxicity. All the pesticides produced statistically significant ( $p = 0.05$ ) reductions in larval shell length after 10 to 20 days of exposure. Relative to potency, methoxychlor was the most toxic, and 2,4-D was the least toxic. The 96-hour TL<sub>50</sub> values for each pesticide, based on adult survival and attachment data, were estimated, as were the 48-hour EC<sub>50</sub> values based on data from embryo bioassays. The effects on embryo development of delaying the time of fertilization and of using seawater larval culture media of various ages also were studied, and substrate preference by metamorphosing larvae was investigated. A critical evaluation of the experimental approach and procedures is presented. (EPA)

W75-10021

#### STUDIES TO DETERMINE METHODS FOR CULTURING THREE FRESHWATER ZOOPLANKTON SPECIES,

Fish and Wildlife Service, Yankton, South Dakota, North Central Reservoir Investigations. For primary bibliographic entry see Field 5A.

W75-10027

#### THE RESPONSE OF *GYMNODINIUM BREVE* TO MUNICIPAL WASTE MATERIALS,

University of South Florida, Tampa. Dept. of Chemistry.

M. T. Doig, III, and D. F. Martin.

Mar Biol (Berl). Vol 24, No 3, p 223-228, 1974, Illus.

Descriptors: \*Eutrophication, Nutrients, Effluents, \*Sewage effluents, \*Water pollution sources, Biocontrol, Wastes, \*Fish diseases, \*Municipal wastes, Microorganisms, \*Dinoflagellates, \*Gymnodinium, \*Florida, Fish-kills.

Identifiers: \*Gymnodinium-breve, Orthophosphate.

The response of the unarmored dinoflagellate *G. breve*, which is the causative organism in catastrophic fish kills along the Florida Gulf Coast, to enrichment with selected inorganic nutrients, municipal waste materials and various detergent components has been determined. The biostimulatory effects of the various enrichments were determined by a modification of the Provisional Algal Assay Procedure of the Joint Industry/Government Task Force on Eutrophication. Inorganic nutrients (orthophosphate, nitrate and ammonia) were added individually and in combination, and the results were compared to equivalent enrichments with the effluent from a

secondary sewage-treatment plant. The maximum cell population, N sub max, attained could be increased 3-fold by the sewage-treatment plant effluent or by the equivalent combination of inorganic nutrients; individually, however, the inorganic nutrients had no pronounced effect on maximum cell population, N sub max (except for a 30% increase produced by slight orthophosphate enrichment). The results of these studies indicate that, at concentrations of orthophosphate typical of Florida coastal waters (about 0.10 ppm), the growth-promoting potential (as reflected by N sub max) of the medium was a linear function of the ammonia-nitrogen concentration (0.01 to 0.11 ppm). The sewage-treatment plant effluent was presumably low in detergent phosphate, having been obtained from a treatment plant some 6 mo. after the enactment of a ban on phosphate-containing detergents. Additions of orthophosphate or detergent-phosphate to the treatment-plant effluent did not significantly increase the observed biostimulatory effect of the waste material. (Copyright 1974, Biological Abstracts, Inc.)

W75-10033

#### COMPARISON OF AUTOCLAVE AND ETHYLENE OXIDE-STERILIZED MEMBRANE FILTERS USED IN WATER QUALITY STUDIES,

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 5A.

W75-10048

#### CRITICAL LEVELS OF PHOSPHORUS AND NITROGEN IN TEXAS IMPOUNDMENTS,

Texas Univ., Dallas. Inst. for Environmental Studies.

G. F. Lee.

IES Occasional Publication No 2 (undated). 7 p.

Descriptors: \*Standards, \*Nutrients, \*Eutrophication, \*Arid climates, \*Texas,

Phosphorus, Nitrogen, Impoundments, Federal Water Pollution Control Act, Water pollution control, Management, Water quality, Subtropic.

Identifiers: \*Critical nutrient levels, Warm-water lakes.

The approach necessary to establish critical nutrient loading criteria for Texas' impounded waters is discussed. Texas impoundments have a wide variety of water quality although they are rarely classified as oligotrophic. The question is: what is the aquatic plant nutrient load that causes significant water quality deterioration in warm-water lakes. In addition to affecting how the public perceives algal growth in Texas impoundments, turbidity due to erosional materials could have a pronounced effect on how a certain nutrient load affects algal growth. After review of available information on aquatic plant-nutrient response in lakes and impoundments throughout the U.S., it is concluded there is insufficient information today to establish critical nutrient concentrations or loads for Texas impoundments. Because of the importance of criteria in developing water quality management plans, it is recommended no attempt be made to develop criteria at this time as these standards must be based on situations specifically applicable to Texas. Consideration must be given to the public's response to water quality, recreational and other uses as a function of algal and other aquatic plant growth, and the limnological and environmental chemical aspects of nutrient transport and cycling. (Jones-Wisconsin)

W75-10072

#### PRELIMINARY RESULTS OF A STUDY CONCERNING THE EFFECTS OF THERMAL POLLUTION ON PHYTOPLANKTONIC PRIMARY PRODUCTION IN LAKE WABAMUN, ALBERTA,

Alberta Univ., Edmonton. Dept. of Zoology.

L. Noton.

In: Proceedings, Symposium on the Lakes of Western Canada, 1973, Water Resources Centre, University of Alberta, Edmonton, p 304-312, 1 fig., 1 tab.

Descriptors: \*Thermal pollution, \*Phytoplankton, \*Primary productivity, Canada, Electric powerplants, Surface waters.

Identifiers: \*Lake Wabamun(Alberta).

Production of phytoplankton was monitored for thirteen months to determine productivity rates for Lake Wabamun, Alberta, as a whole and effects on these rates of warm water effluent from two electric generating stations. Phytoplankton were enumerated, chlorophyll-a determined, and chemical analysis of the water made. Production rates at the surface of the warm water effluent at Wabamun plant were significantly greater than surface rates at other stations. However, productivity at 0.5 m and 1.0 m was unaffected. Similarly, the surface rates for the Wabamun plant area in general were higher than those of the open lake but rates were not higher at depths of 0.5 m and 1.0 m. Winter production in the open area was greater at the Wabamun station than at the central area at the surface only. The Sundance power area in general showed greater production at the surface than did the open area during summer 1972. There were no differences at the 0.5 m and 1.0 m depths. One Sundance station had lower rates than any of the other Sundance stations when power plant was not operating. Resumption of plant operations coincided with an increase in productivity at this station to the level of the other Sundance stations. (Jones-Wisconsin)

W75-10073

#### CHANGES IN THE SUBMERGED MACROPHYTE COMMUNITIES OF LAKE WABAMUN AS A RESULT OF THERMAL DISCHARGES,

Alberta Univ., Edmonton. Dept. of Botany.

E. D. Allen, and P. R. Gorham.

In: Proceedings Symposium on the Lakes of Western Canada, June 1973, Water Resources Centre, University of Alberta, Edmonton, p 314-324, 8 fig., 5 ref.

Descriptors: \*Submerged plants, \*Aquatic weeds, \*Thermal pollution, Canada, Chara, Powerplants, Water temperature, Succession, Adaptation.

Identifiers: \*Lake Wabamun(Alberta), Elodea canadensis, Myriophyllum, Potamogeton pectinatus.

To define factors responsible for the large amount of submerged macrophytes in Lake Wabamun, a survey of species was made. *Elodea canadensis* had not been previously listed, is rare in Alberta, but was the dominant species present. It had replaced *Myriophyllum* and *Chara* between 1961-1968. After the Sundance Power Plant began operations in 1970, *Elodea* and *Myriophyllum* gradually decreased and *Potamogeton pectinatus* increased in the discharge canal. In the discharge canal mouth, *Myriophyllum* died out in a year. In September much of the *Chara* died, possibly due to reduced light and photosynthesis coupled with isothermal heating and increased respiration; that is respiratory loss exceeded photosynthetic gain for a few days, opening a habitat for *Elodea* invasion, which was followed by consolidation and extensive spread in the direction of the prevailing pattern of the plume. Presumably a similar situation had occurred near the Wabamun power plant in 1967. In Kapasiwin Bay, fluctuations in weed growth were better correlated with water level variations and hours of sunshine than with thermal effluent from the Wabamun plant. Weed problems in Lake Wabamun appear to be a consequence of the operation of two power plants rather than production of increased quantities; the species change aggravated the situation. (Buchanan-Davidson-Wisconsin)

W75-10074

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

#### THE EUTROPHICATION OF LAKES IN THE OKANAGAN VALLEY, BRITISH COLUMBIA, Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst. K. Patalas.

In: Proceedings Symposium on the Lakes of Western Canada, June 1973, Water Resources Centre, University of Alberta, Edmonton, p 336-346, 2 fig, 3 tab, 16 ref.

Descriptors: \*Eutrophication, \*Lakes, Canada, Lake basins, Dissolved solids, Calcium, Conductivity, Sodium, Potassium, Magnesium, Copepods, Crustaceans, Daphnia, Plankton, Zooplankton, Secchi disks, Dissolved oxygen, Hypolimnion, Stratification, Oligotrophy, Mesotrophy, Nutrients, Phosphorus, Forecasting. Identifiers: Lake Okanagan(British Columbia), Lake Skaha(British Columbia), Lake Osoyoos(British Columbia), Lake Wood(British Columbia), Lake Kalamalka(British Columbia). W75-10078

Eutrophication was studied in 1969-71 in five lakes in the Okanagan Valley. Four basins were identified in Lake Okanagan. The total dissolved solids, calcium, and electrical conductivity decreased from north to south. Macroelements in lakes Okanagan, Skaha, and Osoyoos were not substantially different, but Lakes Kalamalka and Wood were twice higher in sodium, potassium, and magnesium and about 1.5 times in total dissolved solids. Four copepods and nine cladocerans were found; four species, Cyclops bicuspidatus thomasi, Diaptomus ashlandi, Diaphanosoma leutchtenbergianum, and Daphnia longiremis were dominant in all the lakes and Daphnia thorata was common in four lakes. The upper 50 m contained 89% of the total plankton in Lake Okanagan, and there was little horizontal variation. Crustaceans were less abundant in inshore waters. Settled net plankton volume varied. Compared to 1935 data, there was little change in the zooplankton species, Secchi disc visibility, and dissolved oxygen in the hypolimnion, but net plankton values were greater. Lakes Okanagan and Kalamalka were oligotrophic but close to mesotrophic; Lake Wood moderately eutrophic, and Lakes Skaha and Osoyoos markedly eutrophic. Changes during the past century and predictions for 1990 about the phosphorus loads are made. (Buchanan-Davidson-Wisconsin) W75-10075

#### SURVEY OF LAKE REHABILITATION TECHNIQUES AND EXPERIENCES, Wisconsin Dept. of Natural Resources, Madison. R. C. Dunst, S. M. Born, P. D. Uttermark, S. A. Smith, and S. A. Nichols.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-236 146, \$7.00 in paper copy, \$2.25 in microfiche. Technical Bulletin No 75, 1974, 182 p, 2 fig, 18 tab, 4 photos, 819 ref, 1 append. R 802242.

Descriptors: \*Water pollution treatment, \*Lakes, \*Rehabilitation, \*Technology, Eutrophication, Reviews, Bibliographies, Management, Diversion, Waste water treatment, Land use, Dredging, Nutrient removal, Harvesting, Biocontrol, Sediment control, Harvesting of algae, Drawdown, Lake sediments, Chemcontrol, Fish, Parasitism, Aquatic weed control. Identifiers: \*Lake restoration, \*State-of-the-art, Case studies, Flushing.

International concern has stimulated considerable research on the nature and causes of the lake aging process, including the development of various control techniques. There is presently great need for a compilation of information which thoroughly documents the broad spectrum of lake restoration-oriented activities. Studies that are essential adjuncts to any nutrient limitation program include bioassays, nutrient budgets, hydraulic and phosphorus residence times, and nutrient exchange reactions. Present lake rehabilitation capabilities are substantial, although in need of extensive, well-documented testing, and future

prospects for success in this realm of environmental management are very encouraging. This state-of-the-art review represents an attempt to delineate the accomplishments of lake restoration-related activities worldwide. Information was acquired through an extensive mail survey (about 8000 entries), cooperation of several international journals/newsletters, and a systematic literature search including foreign as well as domestic materials. The contents of this report consist of five major divisions: identification, description and present utility of the various techniques; compilation and description of individual past and/or ongoing restoration experiences (almost 600 accounts); project methodology; name and address of people providing pertinent information (over 300 respondents); and literature references (more than 800 documents). (Jones-Wisconsin) W75-10078

#### FAUNA AND FLORA IN HYDRAULIC CLAM DREDGE COLLECTIONS FROM FLORIDA WEST AND SOUTHEAST COASTS, Florida Dept. of Natural Resources, St. Petersburg. Marine Research Lab.

M. F. Godcharles, and W. C. Jaap. Available from the National Technical Information Service, Springfield, Va. 22161, as COM-74 10276, \$4.75 in paper copy, \$2.25 in microfiche. Special Scientific Report No 40, December 1973. 89 p, 17 fig, 2 tab, 9 ref.

Descriptors: \*Marine algae, \*Marine animals, \*Marine plants, \*Varieties, \*Florida, Coasts, Mollusks, Crustaceans, Habitats, Fish, Annelids, Clams, Ecological distribution, Sampling, Gulf of Mexico. Identifiers: Echinoderms, Cnidarians, Atlantic coast, Dredge sampling. W75-10080

Two exploratory programs to locate commercial clam populations off west and southeast Florida were carried on. An adjunct to these endeavors was the analysis of associated fauna and flora collected by two gear types: a hydraulic Nantucket dredge operated from the R/V Hernan Cortez and a Maryland escalator soft-shell clam dredge, operated from the R/V Venus. The chief distinctions between these two gear types were that the Venus operated in shallower depths (0.9 to 4.6 m) and that its conveyor belt system provided continuous harvesting and was more selective for smaller clams because of smaller mesh size. In contrast, operating depth of the Nantucket dredge was 3.1 to 14.6 m. Florida east coast and shallow estuarine west coast areas were explored with the R/V Venus. A total of 453 taxa, primarily mollusks (64 gastropods, 95 bivalves), crustaceans (111), fish (57), echinoderms (36), annelids (32), and cnidarians (30) were identified. Depth, water temperature, salinity, substrate type, and water clarity were recorded at each station. An effort was made to collect, identify and count all live specimens and these are listed by locality, depth, and numbers collected. (Jones-Wisconsin) W75-10079

#### PESTICIDES, POLYCHLORINATED BIPHENOLS AND HEAVY METALS IN UPPER FOOD CHAIN LEVELS, EVERGLADES NATIONAL PARK AND VICINITY, Everglades National Park, Homestead, Fla. Div. of Natural Science and Resource Management Studies.

J. C. Ogden, W. B. Robertson, G. E. Davis, and T. W. Schmidt. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-235 359, \$3.75 in paper copy, \$2.25 in microfiche. Ecological Report No DI-SFEP-74-16, March 1973. 28 p, 2 tab, 29 ref.

Descriptors: \*Pesticides, \*Polychlorinated biphenols, \*Heavy metals, \*Food chains, Florida, Insecticides, DDT, DDE, DDD, Dieldrin, Arsenic compounds, Mercury, Cadmium, Lead, Zinc.

Copper, Aquatic animals, Chlorinated hydrocarbon pesticides, Baseline studies, Birds, Fish, Shellfish, Frogs, Toxicity, Pesticide residues. Identifiers: \*Everglades National Park(Fla), Alligators, Crocodiles, Eggs.

This investigation was designed to compile baseline information on the distribution of pollutants which are known to, or strongly suspected of, adversely affecting upper trophic level vertebrates and invertebrates present in south Florida environments. Ninety-five samples, including brain and breast tissue and eggs of various birds, alligator and crocodile eggs, fish and shellfish, and frogs were analyzed for residues of chlorinated insecticides (DDT, DDE, DDD, and Dieldrin), and for the persistent chlorinated industrial compounds polychlorinated biphenols. Each sample was also tested for residues of arsenic, mercury, cadmium, lead, zinc and copper. The resulting analyses provide a baseline for future analyses, and clues for particular poisons or particular species in need of more intensive study. These data revealed that DDT, DDE, DDD, Dieldrin, and PCBs appear to exist in concentrations well below amounts known to have either acute or chronic effects on local species. Less is known of the significance of the various metal concentrations reported here, although levels of mercury in freshwater vertebrates, and arsenic in marine species are great enough to deserve more intensive study. (Jones-Wisconsin) W75-10080

#### RECOVERY OF POLLUTED LAKES. A SWEDISH RESEARCH PROGRAM ON THE EFFECTS OF ADVANCED WASTE WATER TREATMENT AND SEWAGE DIVERSION, Uppsala Univ. (Sweden). Algal Assay Lab. C. Forsberg, S.-O. Ryding, and A. Claesson. Water Research, Vol 9, No 1, p 51-59, 1975. 4 fig, 7 tab, 31 ref.

Descriptors: \*Water pollution control, \*Lakes, \*Waste water treatment, \*Sewage, \*Diversion, Phosphorus, Eutrophication, Monitoring, Nutrients, Limiting factors, Chlorophyll, Suspended solids, Nitrogen, Bioassay, Europe, Investigations, Nutrient removal. Identifiers: Lake restoration.

The National Swedish Environment Protection Board began a program in 1972 to analyze the effects of phosphorus removal at advanced waste-water treatment plants on 18 lakes and 15 treatment plants. The effects of diversion of sewage effluents from some lakes are also being investigated. Sewage treatment plant efficiency is continuously monitored by the new Minitest method and the nutrient loads from these plants as well as from other sources are calculated. Water quality is illustrated by the correlation between chlorophyll-a and suspended solids; the correlation coefficient was +0.88. The first sign of lake recovery was observed after an 85% reduction of the waste phosphorus load. Post-precipitation (Al-sulphate) decreased the yearly load from 2000 kg P to 300 kg, which gave a 50% reduction to the recipient water. Chlorophyll values also decreased. The role of nitrogen and phosphorus as algal growth limiting nutrients was studied by algal assay. Nitrogen limited *Seleniastrum capricornutum* growth in two-thirds of the samples. In filtered lake water phosphorus was the growth limiting nutrient at total-P values below 0.05 mg/l. Above 0.1 mg P/l nitrogen played the principal role. Between these values algal growth was primarily limited by P or N or chelating agents. (Jones-Wisconsin) W75-10081

#### NITRATE IN WATER, SOIL, PLANTS AND ANIMALS, Sunning House, Sunningdale (England). A. H. Walters. International Journal of Environmental Studies, Vol 5, No 2, p 105-115, 1973. 4 tab, 46 ref.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

Descriptors: \*Hazards, \*Nitrates, \*Water pollution, \*Path of pollutants, \*Soil contamination, Public health, Fertilizers, Nitrates, Potable water, Crops, Animal pathology, Nitrification.

World aspects of nitrate pollution in water and soils mainly due to excess application of artificial fertilizers are discussed. During the last 20 years it has been scientifically established in many countries that crops, including grass, do not contain excess amounts of nitrate provided they have been grown in naturally manured soils, or in soils which have received moderate and correctly controlled treatments with artificial fertilizers applied within suitable farming systems. It has also been clearly established that the widespread abuse of the use of artificial fertilizers can definitely introduce a health hazard in farm animals due to the uptake of nitrate into the fodder crops, as well as eutrophication and soil structure and fertility breakdown problems. The introduction of nitrate into foodstuffs and water can constitute a human health hazard. The connection between intake of nitrate and methaemoglobinemia in Man and animals has been amply demonstrated, and work is now proceeding to establish a possible connection between nitrosamines and conditions such as cancer and spina bifida. To minimize such hazards it is suggested that much more effective standards on the use of artificial fertilizers is needed. (Jones-Wisconsin)  
W75-10083

#### IDENTITY AND REGULATION OF NUTRIENTS LIMITING PHYTOPLANKTON IN THE SHALLOW ESTUARIES NEAR BEAUFORT, N.C.

National Marine Fisheries Service, Beaufort, N.C. Atlantic Estuarine Fisheries Center.

G. W. Thayer.  
Oecologia (Berl.), Vol 14, p 75-92, 1974. 7 fig, 4 tab, 37 ref.

Descriptors: \*Nutrients, \*Phytoplankton, \*Productivity, \*Limiting factors, \*Estuaries, North Carolina, Nitrogen, Phosphorus, Photosynthesis, Bacteria, Decomposing organic matter, Carbon, Detritus.

Identifiers: \*Beaufort(NC).

Enrichment experiments to test the hypothesis that nitrogen was the prime limiting nutrient and experiments to determine whether microbial competition for nitrogen and phosphorus might limit the availability of these nutrients to the phytoplankton are described. Inorganic nutrients limiting phytoplankton production in the shallow estuarine system near Beaufort, North Carolina were identified. Nitrogen was the primary limiting nutrient and was phosphorus limiting at times. Samples receiving a complete enrichment medium plus organic substrates poor or lacking in nitrogen and phosphorus showed no significant increase in relative photosynthesis over unenriched controls, even though there was a significant decrease in the nitrogen and phosphorus concentrations in the enriched samples. This suggested that microbial immobilization of nitrogen and phosphorus during decomposition of organic matter may limit nutrient availability to phytoplankton and in part account for the general paucity of inorganic nutrients present in this shallow system. The estimated amounts of carbon, nitrogen and phosphorus entering the estuarine system in the form of partially decayed *Spartina alterniflora* each year are given. Data suggested that an annual cycle in nutrient concentration in the estuarine system in part may result from shifts in the equilibrium between microbial immobilization and remineralization. (Jones-Wisconsin)  
W75-10084

#### WATER POLLUTION FROM NONPOINT SOURCES,

Midwest Research Inst., Kansas City, Mo.

A. D. McElroy, S. Y. Chiu, J. W. Nebgen, A.

Aleti, and A. E. Vandergrift.

Water Research, Vol 9, No 7, p 675-681, 1975. 3 tab, 18 ref.

Descriptors: \*Water pollution sources, \*Pollutants, Erosion, Agriculture, Forest management, Mining, Construction, Nutrients, Pesticides, Organic wastes, Thermal pollution, Acid mine water, Grasslands, Sedimentation rates, Saline water, Radioactive wastes, Heavy metals, Farm wastes, Pathogenic bacteria.

Identifiers: \*Nonpoint pollution sources.

The nature and extent of nonpoint pollution sources in the United States were assessed for four major industrial activities: agriculture, silviculture, mining, and construction. Nonpoint pollutants exert a significant influence on water quality in the United States. Based on land use data, more than 97% of the land area in the U.S. is a potential source of nonpoint pollution. Among the pollutants identified from agriculture, silviculture, mining, and construction, important pollutants are sediment, nutrients, pesticides, organic wastes, thermal discharges, acid mine drainage, salinity, radioactivity, microbial pollutants, and heavy metals. Agriculture, especially cropland, is responsible for the release of large quantities of sediment, nutrients, and pesticides. Because of the production of large quantities of organic wastes from livestock operations, these wastes can be potential sources of water quality degradation, if not handled properly. Silviculture is a source of sediment. Other pollutants originating from silvicultural operations include very limited quantities of nutrients, pesticides, and thermal discharges. Surface mining is a major source of erosion sediment. Acid mine drainage, salinity, and heavy metals are other important pollutants from mining. Sediment is a major pollutant from construction industry. (Jones-Wisconsin)  
W75-10085

#### COPPER (II)-NITRILOTRIACETATE COMPLEXES IN AQUEOUS SOLUTION,

Waterloo Univ., Ontario, Dept. of Chemistry.

W. A. E. McBryde, and L. J. McCourt.

Journal Inorganic Nuclear Chemistry, Vol 33, No 12, p 4193-4197, 1971. 1 fig, 4 tab, 4 ref.

Descriptors: \*Copper, \*Copper compounds, \*Nitrilotriacetic acid, \*Chelation, Aqueous solutions, Hydrogen ion concentration, Measurement, Equations, Stability, Potassium compounds.

Identifiers: \*Complexes, NTA.

Previous studies disagreed on the composition and stability of the complex formed by copper (II) and nitrilotriacetic acid. On repeating the experiments, copper was mainly present in the form of complexes in solutions containing an excess of nitrilotriacetic acid, even when the pH was less than 2. Under these circumstances, it is questionable whether pH titration measurements are capable of defining the equilibrium constant. The method of hydrogen ion balance previously used was shown to be unsuitable. The composition of stability constants of copper (II) complexes with nitrilotriacetic acid were studied in aqueous 0.1 molar potassium nitrate solution at 25°C by means of a solid-state copper-ion sensitive electrode. Experimental data could be fitted to equations by assuming that a single species (ML) was formed, but could be better fitted with two formation constants applying to two species, ML and MHL (M equals copper, H3L equals nitrilotriacetic acid). MHL species appeared only at very low hydrogen ion concentrations. The average  $pK_{alpha}$  for the reaction was 1.25. The results indicated that the simple 1:1 complex was the predominant species, but at low pH it became protonated. Log beta ML was 13.21 and log beta MHL was 14.46-14.87, depending on the  $pK_1$  value used for nitrilotriacetic acid. (Buchanan-Davidson-Wisconsin)  
W75-10086

#### NORTH CAROLINA MARINE ALGAE. III. A COMMUNITY OF CERAMIALES (RHODOPHYTA) ON A GLASS SPONGE FROM 60 METERS,

Duke Univ., Durham, N.C. Dept. of Botany.

C. W. Schneider.

Bulletin of Marine Science, Vol 24, No 4, p 1094-1101, 1974. 3 fig, 17 ref. NSF GB-6868, GB-17545, GB-27725.

Descriptors: \*North Carolina, \*Marine algae, \*Biological communities, \*Rhodophyta, Systematics, Benthic flora, Continental shelf, Tropical regions.

Identifiers: Onslow Bay(NC), Gulf stream, Ceramiales, *Antithamnion cruciatum*, *Callithamnion byssoides*, *Heterosiphonia wurdemannii*, *Branchioglossum prostratum*, *Membranoptera subtropica*.

Study of the benthic offshore flora on the continental shelf of Onslow Bay, North Carolina, is reported. The algal flora of this area is characteristically tropical. This part of the shelf lies next to the Gulf Stream system and a bathythermograph cast at the dredge site indicated a bottom temperature of 20.3°C. One particular deep water community of red algae in the order Ceramiales grew epizoically on a glass sponge. The only algae collected in either of two dredges were five members of the Ceramiales (Rhodophyta) recorded from 60 m at the shelf break off North Carolina. These include two taxa previously reported from these shallow waters, *Antithamnion cruciatum* (C. Agardh) Naegli v. *radicans* (J. Agardh) Colling and *Hervey* and *Callithamnion byssoides* Arnott in Hooker, one plant not previously reported from this area. *Heterosiphonia wurdemannii* (Bailey ex Harvey) Falkenberg v. *laxa* Borgesen, and two new species, *Branchioglossum prostratum* sp. nov. and *Membranoptera subtropica* sp. nov. This is the first report of the genus *Branchioglossum* from the Atlantic Ocean. (Jones-Wisconsin)  
W75-10087

#### A MODEL OF INORGANIC CARBON LIMITATION IN NATURAL WATERS,

Texas Univ., Dallas. Inst. for Environmental Studies.

D. W. James, and G. F. Lee.

Water, Air, and Soil Pollution, Vol 3, p 315-320, 1974. 1 fig, 1 tab, 7 ref. EPA 16010-EHR, TG SP2-WP-184-04.

Descriptors: \*Mathematical models, \*Inorganic compounds, \*Carbon, \*Limiting factors, Carbon dioxide, Eutrophication, Algae, Hydrogen ion concentration, Alkalinity.

To understand the role of inorganic carbon in eutrophication, a mathematical model was constructed to determine if inorganic carbon limits planktonic algal productivity in a body of water. The model depends on the ability to account for changes in inorganic carbon species concentrations, especially aqueous carbon dioxide. The basis of the model is the application of the chain rule for partial derivatives, with the rate of pH change calculated as the product of the rate of carbon dioxide change and change in pH as carbon dioxide changes. Given data on gross productivity, algal-bacterial respiration rates, carbon dioxide gas transfer rates, temperature, alkalinity, initial pH, and epilimnion depth, the model calculates the theoretical magnitude of change of pH with change of temperature in the water body during the photosynthetic period. Based on sample calculations under various chemical, physical, and biological conditions, a change in pH to change of temperature ratio greater than 2.0 units was necessary for inorganic carbon limitation to occur. Results suggest that carbon limitation of total planktonic algal growth would be rare in most natural waters, but could occur in low alkalinity water which would influence the species of algae present. (Buchanan-Davidson-Wisconsin)  
W75-10088

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

#### RECENT SEDIMENTARY HISTORY OF LAKE MONONA, WISCONSIN.

Geological Survey, Tacoma, Wash.

G. C. Bortleson, and G. F. Lee.

Water, Air, and Soil Pollution, Vol 4, p 89-98, 1975. 4 fig, 1 tab, 29 ref. EPA 16010 EHR, 5-TO-2-WP-00184.

Descriptors: \*Lake sediments, \*Stratigraphy, \*History, \*Wisconsin, Cores, Pollen, Chemical analysis, Phosphorus, Iron, Manganese, Aluminum, Potassium.

Identifiers: \*Lake Monona(Wis), Ambrosia, Madison(Wis).

Recent historical changes of Lake Monona through interpretation of chemical profiles and Ambrosia (ragweed) pollen of lake sediment cores were examined. Results presented for chemical analyses of each core are mean values of two or five replicate determinations. Duplicate pollen counts were made from each process sample. In the transition zone (high to low ragweed) triplicate counts were made. Chemical analyses from the two short cores show pronounced changes in chemical stratigraphy have occurred since white man moved into Madison and southern Wisconsin and began modifying the area. Since the mid- to late 1800s, there has been an appreciable increase in P, Fe, Mn, Al, and K in the uppermost sediments. Maximum concentrations of P were observed near the turn of the century and in the most recent sediment layers. Data from the two cores do not agree precisely but are within 5 to 10 yr of each other. Among the domestic changes taking place during this period in Lake Monona basin were rapid urbanization of Madison, rapid growth of towns and suburban areas which contribute effluent to the lake's tributaries, and emergence of the 'detergent era' as an additional source of P. (Jones-Wisconsin)

W75-10089

#### FLUXES, RESIDENCE TIMES, AND SOURCES OF SOME ELEMENTS TO LAKE MICHIGAN.

Hope Coll., Holland, Mich. Dept. of Chemistry.

D. H. Klein.

Water, Air, and Soil Pollution, Vol 4, No 1, p 3-8, 1975. 2 tab, 18 ref.

Descriptors: \*Chemical properties, \*Lake Michigan, \*Trace elements, Reviews, Cycles, Sedimentation, Aerosols, Industrial wastes, Municipal wastes, Copper, Mercury, Calcium, Magnesium, Sodium, Chlorine, Aluminum, Bromine, Cobalt, Iron, Potassium.

Identifiers: Antimony, Selenium, Vanadium, Silver, Arsenic, Chromium, Lanthanum, Silicon, Thorium.

Lake Michigan receives a considerable input of trace elements from both natural and societal sources, and as a result the chemistry of the lake is changing. Fluxes of 28 elements to Lake Michigan are calculated from literature data on sedimentation rates and concentrations in sediments and water. Lake Michigan residence times are roughly 1000 lower than oceanic residence times. Despite the multiplicity of sources, it is possible to construct a simple model for trace elements in the lake by using only two source terms: soil and aerosol. The model assumes the industrial and municipal discharge directly to the water has a negligible effect on lake-side average sediment and water concentration, although such discharges may have pronounced localized effects. With soil and aerosol the only sources, fourfold excesses are provided of Cu, Hg, Sb, Se, and V and order of magnitude deficits for Ca, Mg, Na, and Cl, but account (to with 50%) for the observed inputs of Ag, Al, As, Br, Co, Cr, Fe, K, La, Mn, S, Si, Sc, Th, and Zn. Except for Al, Co, La, Si, and Th, deposition from aerosol accounts for at least one-fifth of the total input. (Jones-Wisconsin)

W75-10090

#### MICROBIAL DEGRADATION OF DDT.

Cornell Univ., Ithaca, N.Y.

M. Alexander.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-781 903, \$3.75 in paper copy, \$2.25 in microfiche. ONR Report June 1974. 34 p, 9 fig, 7 tab, 29 ref. NR 306-067. N00014-67-A-0077-0027.

Descriptors: \*Pesticides, \*Microbial degradation, \*Pesticide removal, \*DDT, \*Marine bacteria, Chlorine, Oceans, Fungi, Mode of action, Aromatic compounds.

Identifiers: Mucor alternans, Dechlorination.

Investigations with marine bacteria to determine their ability to convert DDT to water-soluble products are described. Mucor alternans converted DDT to water-soluble metabolites at a rate four times greater than the most active marine bacterium. Techniques were developed to isolate and purify these metabolites. These compounds are different from the previously described DDT metabolites, and they do not contain chlorine. If the absence of chlorine is confirmed, these compounds represent products of the most extensive microbial degradation of DDT yet reported. To model marine communities were added eighty different carbon sources in a total of 100 separate treatments, but in no case were water-soluble products of DDT metabolism detected. Microorganisms were found to be capable of converting diphenylmethane, an analog of DDT to 1,1,1',1'-tetraphenylmethanol ether. Para-substituted aromatic compounds were toxic to some bacteria, even at low levels, but a few stimulated growth of individual bacteria. The relationship of chemical structure to biodegradability of DDT analogs was investigated. Para substitution of one of the two aromatic rings with chloro, nitro, hydroxyl, or amino groups significantly reduced the rate of biodegradability. The most resistant compounds were those with both rings containing these substituents. (Jones-Wisconsin)

W75-10091

#### AN ECOSYSTEM MODEL FOR THE PELAGIC ZONE OF LAKE WINGRA.

Wisconsin Univ., Madison.

A. J. A. MacCormick, O. L. Loucks, J. F. Koonce, J. F. Kitchell, and P. R. Weiler.

International Biological Program, EDFB-IBP 74-7 (Biology and Medicine UC-48), October 1974. 100 p, 9 fig, 23 tab, 12 ref. NSF AG-199, 40-193-69, AEC W-7405-eng-26.

Descriptors: \*Lakes, \*Model studies, Wisconsin, Biomass, Phytoplankton, Zooplankton, Benthos, Fish, Detritus, Sediments, Organic matter, Phosphorus, Ecosystems, Productivity, Computer programs.

Identifiers: \*Pelagic zone, \*Lake Wingra(Wis).

The status of an open-lake model for the pelagic zone of Lake Wingra, Wisconsin designed to simulate the transfer of biomass at a relatively aggregated level of resolution, is described. Although the resolution is intended to be gross, and the output cannot be expected to show the sharp variation of individual process sub-models, the pelagic zone model leans heavily on the lessons from the process sub-models. It is intended to address questions concerning general response characteristics rather than questions of detail. It is an attempt to represent a projection of the real ecosystem into the subspace defined by the variables. These variables are incorporated in the model, and a 'true' model would be an exact mathematical representation of the projection. However, the projection cannot be known. It was the intention to base the model on understanding gained from the detailed process studies of the different components, e.g., phytoplankton, zooplankton, benthos, etc. Because different process studies are at different stages of development, all the mathematical detail of the process models are not included in the general model. It is

felt that the model works well and the results and insight it provides are good. (Jones-Wisconsin)

#### THE STRUCTURE AND PRODUCTION OF PHYTOPLANKTON IN MIKOŁAJSKIE LAKE.

Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology.

I. Spodniawska.

Ekologia Polska, Vol 22, No 1, p 65-106, 1974. 10 fig, 14 tab, 74 ref.

Descriptors: \*Biomass, \*Productivity, \*Phytoplankton, Eutrophication, Diatoms, Dinoflagellates, Biological communities, Trophic level, Nannoplankton, Deep-water habitats, Varieties, Algae, Distribution, Decomposing organic matter, Period of growth, Seasonal, Europe. Identifiers: \*Mikołajskie Lake(Poland), Holomictic lake.

In order to determine the direction and rates of changes in the trophic level of lakes, preliminary studies were conducted in the pelagic zone of Mikolajskie Lake in the Masurian Lakeland of Poland (eutrophic, holomictic, maximum depth 27.8 m). The seasonal variability of composition, biomass and production of phytoplankton in different years of the studies (1963-1970) was analyzed. In the phytoplankton development, two maxima were observed: that in spring—having relatively small biomass of algae (averaging about 6 mg/l) and distinct domination of diatoms in the plankton, and that in summer—with a much higher algal biomass (10-30 mg/l) and dominated by dinoflagellates. The mean phytoplankton production in spring and summer remained on a constant level (about 1.0 mg oxygen per day) despite the directional changes in the phytoplankton structure and distinct increase of algal biomass in summer during the last years of the studies. Simultaneously an increase of maximal values of phytoplankton production and an increase of decomposition of organic matter has been observed. Both the species composition and seasonal dynamics of phytoplankton development and the values of biomass and production of planktonic algae in this lake are typical for naturally eutrophic lakes, of average fertility and with a distinct periodicity of phytoplankton development. (Jones-Wisconsin)

#### EXPERIMENTALLY INCREASED FISH STOCK IN THE POND TYPE LAKE WARNIAK. I. PHYSICAL AND CHEMICAL CONDITIONS IN LAKE WATER.

Instytut Rybactwa Srodladowego, Gazycko (Poland). Lake Field Station.

J. Zachwieja.

Ekologia Polska, Vol XXI, No 27, p 405-421, 1973. 6 fig, 2 tab, 38 ref.

Descriptors: \*Fish stocking, \*Physical properties, Chemical properties, \*Lakes, Ice cover, Temperature, Stratification, Oxygen, Winterkill, Aquatic plants, Secchi disks, Conductivity. Identifiers: \*Lake Warniak(Poland).

Physical and chemical studies of Lake Warniak, Poland have been carried out in connection with studies of the effect of newly introduced fish species on the original fish stock. Duration of the ice cover ranged from 90 to 143 days (average 53 days). Maximum temperature of surface water was 32.4°C and at 3 m, 24.2°C. A distinct correlation was observed between the mean daily wind velocity, air temperature and water temperature. Periods of vertical thermal compensation coincided with drop of air temperature and greater wind velocity. The reverse accompanied the temporary stratification. Among *Elodea canadensis* stands temperature of water was 0.4-3.0°C higher than in the weed-free places. Only during the winter periods were there oxygen losses causing a winterkill depending on meteorological conditions, thickness and structure of ice and snow cover, and

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

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oxygen contents before freezing. The winterkill was very severe in 1969/1970. Lowest visibility was observed in July and August, and highest in autumn and winter. Seasonal and yearly variation of some physical and chemical elements was observed, especially of iron, alkalinity, carbon dioxide, calcium and conductivity. (Jones-Wisconsin) W75-10094

#### PHOSPHORUS RUN-OFF FROM THE DRAINAGE BASIN TO MIKOŁAJSKIE LAKE, Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology.

T. Gorski, and J. I. Rybak. *Ekologia Polska*, Vol 22, No 2, p 275-286, 1974. 1 fig, 3 tab, 67 ref.

Descriptors: \*Measurement, \*Runoff, \*Watersheds(Basins), \*Nutrients, Statistical methods, Europe.

Identifiers: \*Mikołajskie Lake(Poland), Non-point nutrient sources.

The method for quantitatively estimating the runoff of substances from a drainage basin to water bodies and streams from scattered sources is presented. Using phosphorus as an example, literature data and data on the abundance of phosphorus in the drainage basin of Mikolajskie Lake allowed calculation of the amount of phosphorus runoff from various sources within one year. The calculation is based on following sources of substances (in this instance phosphorus) in-flowing from the drainage basin: surface and groundwater runoff, erosion (water erosion of soil drainage basin, shore erosion, wind erosion), litter fall, substances brought in by animals, substances brought in with precipitation, effect of tourism, and municipal sewage. The drainage basin of Mikolajskie Lake (surface 810 ha) was divided into four parts, each having different biological and geographical parameters. The forest and the towns were separated. The remaining surface of the drainage basin was divided into the area between town and forest, partly with buildings, and partly used for agricultural purposes, and the flat area which was almost entirely used for agriculture. Calculations show that the most significant source of phosphorus is municipal sewage (86.0% of total phosphorus), followed by surface runoff. Other sources are not important. (Jones-Wisconsin) W75-10095

#### FLUVIAL-ESTUARINE WATER RESOURCE OPTIMIZATION: MICROECOSYSTEM SIMULATION OF RIVER-ESTUARINE PRODUCTIVITY RELATIONSHIPS, For primary bibliographic entry see Field 2L. W75-10099

#### PHOSPHORUS KINETICS IN THE EUPHOTIC ZONE OF THE CHESAPEAKE BAY, Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

J. L. Taft, and W. R. Taylor. Available from the National Technical Information Service, Springfield, Va 22161 as COO-3279-08, \$4.00 in paper copy, \$2.25 in microfiche. Report COO-3279-08 (Undated). 16 p, 9 fig, 8 ref. AEC AT(11-1)3279.

Descriptors: \*Phosphorus, \*Kinetics, \*Euphotic zone, \*Chesapeake Bay, Phytoplankton, Growth rates, Cycling nutrients.

There are at least three phosphorus cycles in natural waters. One cycle, the kinetic steady state between phosphorus in phytoplankton and bacteria and dissolved P, is evaluated. The experimental design allowed measurement of the flux of biologically active phosphorus compounds in a living system at ambient nutrient concentrations and reaction rates. It was concluded that when soluble reactive phosphorus concentration is very low,

rapid initial P-32 uptake is due to exchange across cell membranes, not to net uptake. The rate constants used for P flux are those for exchange across cell membranes. Michaelis-Menton kinetic experiments frequently evaluate uptake rate by filtration at a single time interval following tracer addition. This practice leads to overestimation of net uptake at low ambient concentrations because some P-32 incorporation is due to exchange. The fraction of uptake due to exchange may be appreciable, demonstrated by Chesapeake Bay data in June, 1973. Since phosphorus appears to limit phytoplankton growth during most of the year in Chesapeake Bay, the slow rate of P-32 uptake may approximate growth rate. It will underestimate growth rate according to the net rate of P uptake from organic molecules and polyphosphates. (Jones-Wisconsin) W75-10101

#### MEASUREMENTS OF ABSOLUTE SCALAR IRADIANCE SPECTRA IN RHODE RIVER, Johns Hopkins Univ., Baltimore, Md. McCollum-Pratt Inst.

W. E. Esaias, W. H. Biggley, and H. H. Seliger. Available from the National Technical Information Service, Springfield, Va 22161 as COO-3278-24, \$4.00 in paper copy, \$2.25 in microfiche. COO-3278-24 (Undated). 31 p, 9 fig, 23 ref. AEC AT(11-1)3278.

Descriptors: \*Solar radiation, \*Measurement, \*Spectrometers, \*Attenuation, Estuaries, Chesapeake Bay, Phytoplankton, Light intensity, Analytical techniques, Absorption, Wavelengths. Identifiers: \*Rhode River(Md), Scalar irradiance spectra, Turbid waters.

To date there have been no direct measurements of underwater photon scalar irradiance spectra in turbid waters. An attempt to make these measurements by coupling a spherical diffusing collector to an underwater scanning spectrometer is reported. The design and calibration of the instrument and preliminary results obtained in the Rhode River, a subestuary of Chesapeake Bay, are described. The high attenuation in the blue is readily apparent and the attenuation near 680 nm and into the far red. The sharp peak at 700 nm is the result of absorption by chlorophyll at 680 nm and infrared absorption by water at 750 nm, both of which are accentuated by the high scattering. The shape of spectral attenuation curve has been a consistent feature during the past three years of observation. The extremely high total and selective absorptions of sunlight are characteristic of the shallow tributary estuaries of the Chesapeake Bay. The phytoplankton is subjected to extreme ranges of ambient light over short time periods and is strongly selected on the basis of chromatic adaptation. The spectral distribution of light at depth is essentially sunlight minus plant pigment absorption, with additional absorption in the blue by suspended material. (Jones-Wisconsin) W75-10102

#### GROWTH AND DISSIPATION OF PHYTOPLANKTON IN CHESAPEAKE BAY. III. INORGANIC CARBON REQUIREMENTS OF NATURAL POPULATIONS AND LABORATORY CULTURES OF PHYTOPLANKTON, Johns Hopkins Univ., Baltimore, Md. McCollum-Pratt Inst.

M. E. Loftus, A. Place, and H. H. Seliger. Available from the National Technical Information Service, Springfield, Va 22161 as COO-3278-21, \$4.00 in paper copy, \$2.25 in microfiche. COO-3278-21 (Undated). 34 p, 7 fig, 3 tab, 33 ref. AEC AT(11-1)3278, NSF GI-32110.

Descriptors: \*Photosynthesis, \*Absorption, \*Phytoplankton, \*Carbon, Chesapeake Bay, Inorganic compounds, Cultures, Kinetics, Pyrrhophyta, Cyanophyta, Chlorophyta, Bicarbonates, Nannoplankton, Dinoflagellates, Mathematical studies.

Identifiers: *Gymnodinium nelsoni*, *Prorocentrum minimum*, *Dunaliella tertiolecta*.

Results of a detailed study of C-14 kinetics uptake in natural samples and in unialgal laboratory cultures are presented. Natural phytoplankton samples from Chesapeake Bay were collected at ca. 0.5 m depth between 1100-1300 h by Van Dorn bottle or as integrated samples pumped from 0.5 m depth along a transect. The laboratory unialgal cultures consisted of two Pyrrhophyta, *Gymnodinium nelsoni* and *Prorocentrum minimum*, one Cyanophyta, an unidentified unicellular blue-green alga, and Chlorophyta, *Dunaliella tertiolecta*. The rates of photosynthetic carbon fixation for natural populations of phytoplankton and for unialgal cultures of species isolated from those populations follow hyperbolic saturation kinetics with respect to total inorganic carbon concentrations. The apparent half-saturation constants, measured by C-14 uptake, are close to and in some cases larger than ambient concentrations of total inorganic carbon. Addition of bicarbonate ion to incubation bottles increased the measured C-14 uptake rates by factors as high as 2.5 for natural samples and 4.5 for laboratory cultures. There is evidence that nannoplankton have lower half-saturation values than larger dinoflagellates. The significant difference in half-saturation between *G. nelsoni* and *P. minimum* may have some relationship to their seasonal occurrence. (Jones-Wisconsin) W75-10103

#### EDUCING AND MODELING THE FUNCTIONAL RELATIONSHIPS WITHIN SUBLITTORAL SALT MARSH AUFWUCHS COMMUNITIES - INSIDE ONE OF THE BLACK BOXES, City Coll., New York. Dept. of Biology. J. J. Lee.

Available from the National Technical Information Service, Springfield, Va 22161 as COO-3254-16, \$4.00 in paper copy, \$2.25 in microfiche. AEC COO-3254-16 (Undated). 31 p, 4 fig, 2 tab, 60 ref. AEC COO (11-1)3254, NSF GB 19245.

Descriptors: \*Periphyton, \*Model studies, \*Salt marshes, Population, Nematodes, Algae, Microorganisms, Dynamics, Trophic level, Protozoa, Bacteria, Diatoms, Competition, Niches, Food webs, Biological communities.

Identifiers: Foraminifera, Long Island(NY).

For the best part of 5 years, the distribution and population structure of foraminifera during 3 growing seasons in a relatively small but very productive sublittoral portion of a Long Island salt marsh have been studied and analyzed. Salt marsh aufwuchs communities are extremely complex assemblages of more than several hundred species of bacteria, fungi, algae, protozoa and micrometazoa. At the present time information on the population structure is too fragmentary to be used in modeling and predicting community structure. Studies of foraminifera, nematodes, and microalgae grown in gnotobiotic culture suggest it is unreasonable to assume that measurements made on one species will be good estimators for similar parameters of other species or the assemblage as a whole. Nutritional experiments suggest many meiotauna are selective feeders and gain different nutritional values from the food they assimilate. If the phenomena of balanced diets and special growth factors are widespread among meiotauna, it may be necessary to reconsider certain aspects of energy flow modeling. Simulation of the trophic dynamics of *Allotrochus laticollaris* was used to organize the information and to serve as a generator of predictions to be further tested experimentally. (Jones-Wisconsin) W75-10104

#### DIATOMS IN LAKES AND LAKE SEDIMENTS AS AN INDEX TO ENVIRONMENT. PART 2. A STUDY OF PHYTOPLANKTON DISTRIBUTION, LAKE CLASSIFICATION, AND

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

#### TROPHIC INDICATORS IN MINNESOTA LAKES, Minnesota Univ., Minneapolis.

S. J. Tarapchak.

Available from the National Technical Information Service, Springfield, Va 22161 as COO-2046-2, \$7.60 in paper copy, \$2.25 in microfiche. Final Report COO-2046-2, May 1, 1969-April 20, 1972. 230 p, 43 fig, 58 tab, 111 ref. AEC AT(11-1)2046.

Descriptors: \*Trophic level, \*Bioindicators, \*Diatoms, \*Lakes, Lake sediments, Phytoplankton, Distribution patterns, Classification, Minnesota, Biological communities, Standing crops, Chrysophyta, Cyanophyta, Oligotrophy, Mesotrophy, Eutrophication, Conductivity, Alkalinity, Calcium, Magnesium, Secchi disks, Mathematical studies, Salinity, Physicochemical properties.

Identifiers: Desmids, Species diversity, Lake classification.

Patterns in phytoplankton distribution were delineated, lake classification investigated, and properties of net phytoplankton, diatom assemblages, and whole-water phytoplankton communities as indicators of trophic state evaluated. Range of trophic conditions was defined by specific conductance, alkalinity, a summation of calcium and magnesium, secchi disc transparency, and phytoplankton standing crop. Lakes were classified by performing cluster analysis on concentrations of major solutes, combinations of eight trophic-state indicators, and suites of phytoplankton taxa. The number of net taxa, desmids, and the compound quotient is correlated with the trophic gradient, but diatom ratios and the diversity of these assemblages are not so correlated. Conversely, the standing crop of phytoplankton and species diversity in whole-water samples exhibit statistically significant correlations with regional gradient parameters. Typological studies reveal that lake groupings, based on different sets of variables, are dissimilar in size, composition, and location, especially those that involve biological variables. Algal properties that exhibit distinct trophic preferences are the numbers of net taxa and desmids, standing crop, and species number of whole-water communities. Desmids, chrysophytes, diatoms, and blue-green algae contain taxa that are indicators of oligotrophy and mesotrophy. (Jones-Wisconsin)  
W75-10105

#### USE OF ALGAE, ESPECIALLY DIATOMS, IN THE ASSESSMENT OF WATER QUALITY, Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.

For primary bibliographic entry see Field 5A.

W75-10112

#### WATER POLLUTION STUDY OF MALABEAM LAKE, GREENLAW BROOK AND ADJACENT STREAMS ON LORING AFB, MAINE, Environmental Health Lab., Kelly AFB, Tex.

J. M. Davidson.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-785 373, \$4.75 in paper copy, \$2.25 in microfiche. Report EHL (K) 74-18, September 1974. 84 p, 14 fig, 24 tab, 12 ref, 2 append.

Descriptors: \*Water pollution sources, \*Pollution abatement, Streams, Lakes, Biomass, Food processing industry, Dissolved oxygen, Fluvial sediments, Pesticide residues, Bioindicators, Coliforms, Public health, Sewage treatment, Benthos, Industrial wastes, Sewage effluents, Sport fish, Invertebrates, Toxins, Heavy metals, Maine, Water Quality Standards, Water sampling, Physical properties, Chemical properties, Pesticides.

Identifiers: \*Loring Air Force Base(Me), Greenlaw Brook(Me), Malabean Lake(Me).

Greenlaw Brook and Malabean Lake within the periphery of Loring Air Force Base, Maine was studied in June 1973. Surveys indicated the east branch of Greenlaw Brook was chronically polluted by industrial wastes from various base shops. Iron-fixing bacteria were the only living organisms in the upper portion of the stream. Contamination of Malabean Lake and the west branch of Greenlaw Brook was not considered harmful to human health or aquatic life. The main part of Greenlaw Brook downstream from the sewage treatment plant was polluted with raw and partially treated sewage. This pollution and the industrial waste discharges to the stream's east branch significantly altered the number of organisms and species composition. Game fish could not survive due to invertebrate food supply reduction, breeding habitat elimination, and effects of toxicants and pollutants. It was recommended that industrial waste sources and waste treatment be studied to eliminate future discharges. Water from Malabean Lake should be studied for a year, fish analyzed for heavy metals, and recommendations made. The sewage treatment plant must be upgraded. The east branch and main part of Greenlaw Brook should be off limits until toxic and inadequately treated discharges have stopped and the environment has recovered. (Buchanan-Davidson-Wisconsin)  
W75-10113

#### FIELD AND LABORATORY INVESTIGATIONS TO EVALUATE THE INFLUENCE OF NITRILOTRIACETIC ACID (NTA) ON EUTROPHICATION.

Pacific Northwest Water Lab., Corvallis, Oreg. Available from the National Technical Information Service, Springfield, Va 22161 as PB-234 966, \$4.25 in paper copy, \$2.25 in microfiche. Report May-November 1970. 148 p, 62 fig, 28 tab, 8 ref, 3 append.

Descriptors: \*Nitrilotriacetic acid, \*Eutrophication, Bioassay, Algae, Lakes, Rivers, On-site investigations, Nitrogen, Phosphorus, Carbon, Plant growth, Primary productivity, Minnesota, North Carolina, Oregon, Chelation, Trace elements, Metals, Sediments, Degradation(Decomposition), Adsorption, Phytoplankton, California, Laboratory tests, Detergents.

Identifiers: NTA.

Field and laboratory investigations were conducted to evaluate the potential impact of nitrilotriacetic acid (NTA) on eutrophication.

Studies included laboratory and in situ gal assays on 10 lakes and one river in different geographic areas and of various degrees of water quality. A series of additions (spikes) were made to these waters, including NTA, nitrogen, phosphorus, carbon, secondary sewage effluent resulting from settled primary effluent containing NTA, tertiary treated effluent of the latter, secondary sewage effluent without NTA, and tertiary effluent without NTA. Generally NTA had no dramatic effects on algal growth or primary productivity in Minnesota, North Carolina or Oregon lakes. Where there were stimulatory or inhibitory effects, they appeared to be related to the chelating properties of NTA and interaction with algal trace metal metabolism. Generally the stimulation of algal growth by phosphorus and by secondary sewage effluents was much greater than any stimulation resulting from NTA. There appeared to be an immediate, but slight, disappearance of NTA in lake and river sediments due to adsorption of NTA on particulate matter. After acclimatization there is a rapid disappearance of NTA and results suggest this is due to biochemical (microbial) degradation. (Jones-Wisconsin)  
W75-10115

#### MEASURES FOR THE RESTORATION AND ENHANCEMENT OF QUALITY OF FRESH-WATER LAKES.

Environmental Protection Agency, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price \$2.85. Report EPA-430/9-73-005, 1973. 249 p, 6 fig, 19 tab, 229 ref, 10 append.

Descriptors: \*Water quality, \*Water pollution treatment, \*Water pollution control, \*Lakes, Nutrient removal, Cycling nutrients, Water types, Thermal properties, Public lands, Diversion, Sediment control, Oil wastes, Dredging, Sulfides, Desratification, Ammonia, Aeration, Mercury, Drawdown, Pesticides, Eutrophication, Arsenic compounds, Mechanical control, Biocontrol, Polychlorinated biphenyls, Chemcontrol, Harvesting, Radioactive wastes, Thermal pollution, Management, Water pollution sources, Toxins, Industrial wastes, Municipal wastes, Farm wastes, Mine drainage.

Identifiers: \*Lake restoration, Water displacement, Phthalate esters.

Background information on lake environments followed by state-of-the-art information on remedial measures for enhancing and restoring the quality of lakes, ponds, and reservoirs is presented. The approach to the rehabilitation of degraded lakes is twofold: restricting input of undesirable materials and providing in-lake treatment for removal or inactivation of undesirable materials. Reducing or eliminating the sources of waste loading is the only restorative measure needed to achieve desired level of improvement in certain lakes in which natural flushing results in substantial improvements in quality. Remedial measures which restrict the input of contaminants include advanced wastewater treatment, nutrient diversion and allochthonous sediment control. Advanced wastewater treatment probably represents the best method available for curbing nitrogen and phosphorus input to waterways at moderate costs. Nutrient diversion may result in restoration in situations where incoming nutrient load enters from point sources. Useful existence of a water body can sometimes be prolonged by implementing control measures to reduce sedimentation rate. In-lake treatment measures in lake restoration programs now being investigated include dredging, nutrient inactivation, dilution and displacement, covering sediments, artificial desratification, and hypolimnetic aeration and drawdown. In advanced eutrophication stages attempts have been made to control nuisance organisms through mechanical, biological and chemical means. (Jones-Wisconsin)  
W75-10113

#### THE RECOVERY OF STREAM MACROBENTHOS FROM LOW pH STRESS,

Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology.  
E. E. Herricks, and J. Cairns, Jr.  
Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 843, \$3.25 in paper copy, \$2.25 in microfiche. Presented at The Midwest Benthological Society, 22nd Meeting, March 27-29, 1974. 14 p, 3 fig, 1 tab, 18 ref. OWR B-034-VA(5).

Descriptors: Acid streams, Aquatic insects, Aquatic animals, Biological communities, Aquatic drift, Water quality, \*Virginia, \*Hydrogen ion concentration, \*Benthos, Water pollution effects, Model studies.

Identifiers: Mill Creek(Va), Recovery(Streams).

The effects of short term low pH stress were studied in relation to recovery and restoration of aquatic macrobenthic communities. Experimental acid additions were made to a healthy productive stream, reducing pH to 4.0 from 8.0 for 15 minutes. Diversity and density were decreased (d 3.91 and 74 organisms/sq ft before acid vs. d 2.79 and 43 organisms/sq ft after acid). Recovery was related to downstream drift of recolonizing organisms; full recovery occurred within 19 to 28 days with density and diversity equaling or exceeding pre-stress values. A second study was made to observe drift born recolonizing organisms. *Baetis* sp. dominated

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

drift collections, and was the most abundant taxa in bottom fauna collections indicating a relationship between drift and recovery. Average drift intensity was 10 organisms or less during one 15 minute drift sample; drift rates were calculated to be in excess of 5,000 organisms/day.  
W75-10127

#### THE EFFECTS OF SELECTED HERBICIDES ON BACTERIAL POPULATIONS IN AN AQUATIC ENVIRONMENT,

Clemson Univ., S.C. Dept. of Microbiology.

R. N. Ferebee.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 884, \$4.75 in paper copy, \$2.25 in microfiche. Ph.D. Dissertation, December 1972. 93 p, 15 fig, 10 tab, 70 ref. OWRT A-022-SC(2).

Descriptors: \*Bacteria, Aquatic microorganisms, \*Herbicides, Pollutants, \*Water pollution effects, Culture, Reservoirs, 2,4,5-T, \*Paraquat, Ureas, Organic acids, Eutrophication.

Identifiers: \*Mesophilic bacteria, \*Heterotrophic bacteria, \*Diuron.

A laboratory culture system was used to continuously culture mesophilic, heterotrophic bacteria derived from a freshwater reservoir. Alterations in bacterial numbers and diversity of genera were studied both before and after additions of selected herbicides. Identical techniques for isolation and identification were used to compare culturable heterotrophic bacteria from a freshwater reservoir with those in the laboratory culture system. Three chemicals, representing the phenoxyaliphatic acid, substituted urea, and dipyridyl classes of herbicides, were added to circulating vat culture vessels which contained untreated reservoir water. At concentrations to 1.4 mg/l, 2,4,5-T did not significantly affect that portion of the bacterial population tested. When the bacteria were exposed to 1.4 mg/l paraquat there was an increase in counts and evidence for an enrichment process. Findings following use of this herbicide suggest both direct and indirect effects on the bacterial populations. Diuron (1.4 mg/l) caused rapid increases in total counts with a following decrease. This herbicide also appeared to cause a decrease in genera diversity. The herbicides tested all remained qualitatively measurable in the culture system for three weeks.  
W75-10133

#### THE EFFECT OF A FUEL OIL SPILL ON BENTHIC INVERTEBRATES AND WATER QUALITY ON THE ALASKAN ARCTIC SLOPE, HAPPY VALLEY CREEK NEAR SAGWON, ALASKA,

Geological Survey, Anchorage, Alaska.

J. W. Nauman, and D. R. Kernode.

Available from Sup. Doc. D.C. 20402, \$3.15 single journal copy; \$18.90 yearly subscription rate. Journal of Research of the U.S. Geological Survey, Vol 3, No 4, p 495-500, July-August 1975. 4 fig, 2 tab, 10 ref.

Descriptors: \*Oil spills, \*Environmental effects, \*Alaska, \*Water pollution effects, Benthos, Invertebrates, Water quality, Oily water, Oil pollution. Identifiers: \*Sagwon(Alaska), Happy Valley Creek(Alas.).

Samples of aquatic organisms and water were collected upstream and downstream from leaks and spills of arctic diesel fuel oil into Happy Valley Creek near Sagwon, Alaska. All groups of benthic invertebrates were reduced in abundance at the downstream boundary of the spill area, whereas invertebrates at an upstream site were unaffected. No significant differences in field water-quality characteristics were found between the two sites. (Woodard-USGS)  
W75-10140

#### FISH VIRUSES: BUFFERS AND METHODS FOR PLAQUING EIGHT AGENTS UNDER NORMAL ATMOSPHERE

Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va. Eastern Fish Disease Lab. K. Wolf, and M. C. Quimby.

Appi Microbiol, Vol 25, No 4, p 659-664, 1973.

Identifiers: Atmosphere, Bluegill, Buffers, Carpio, Cells, Channel catfish, Eel, Egret, \*Fish viruses, Hematopoietic, Lymphocystis, Myxovirus, Necrosis, Pancreatic, Plaquing, Rhabdovirus, Viruses, \*Plaque assay, \*Methodology.

A universal procedure was sought for plaque assay of 8 fish viruses (bluegill myxovirus, channel catfish virus, eel virus, Egret virus, infectious hematopoietic necrosis virus, infectious pancreatic necrosis virus, lymphocystis virus and the agent of spring viremia of carp (Rhabdovirus carpio), in dish cultures of various fish cells. Eagle minimal essential medium with sodium bicarbonate-CO<sub>2</sub> buffer (Earle's salt solution) was compared with minimal essential medium buffered principally with tris (hydroxymethyl) aminomethane or N-2-hydroxyethylpiperazine-N'-2'-ethanesulfonic acid at a pH or in the range of 7.6-8.0 depending upon temperature. Five fish cell lines collectively capable of replicating all fish viruses thus far isolated were tested and quantitatively found to grow comparably well in the 3 media. Two-phase (gel-liquid) media incorporating the various buffer systems allowed plaque at 15-33C either in partial pressures of CO<sub>2</sub> or in normal atmosphere, but greater efficiency and sensitivity were obtained with the organic buffers and, overall, the best results were obtained with tris(hydroxymethyl)-aminomethane. Epizootiological data, specific fish cell line response and plaque morphology permit presumptive identification of most of the agents. At proper pH, use of organic buffers obviates the need for CO<sub>2</sub> incubators.—Copyright 1973, Biological Abstracts, Inc.  
W75-10257

#### BENTHAL DECOMPOSITION OF ADSORBED OCTADECANE,

Rutgers - the State Univ., New Brunswick, N.J.

H. L. Allen.

Available from University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No 74-27,578. PhD Thesis, 1974. 351 p.

Descriptors: \*Oil pollution, \*Water pollution effects, \*Dissolved oxygen, Benthos, Environmental effects, Oil wastes, \*Biodegradation, \*Degradation(Decomposition), Adsorption. Identifiers: \*Octadecane.

An experimental flowing stream system was designed to test the environmental impact of octadecane, a significant component of crude oil. It is known that the long term adverse effects of oil pollution are primarily the destruction of the benthos by deposited oil and the reduction in dissolved oxygen concentration. The process involves both aerobic and anaerobic phases. This research attempted to characterize the behavior of a benthic deposit containing octadecane under varying conditions of seed concentration, flow rate, dissolved oxygen concentration, surface area, nutrient concentration, and salt concentration, and to determine rate controlling factors. Its objective was also to determine the relationship between the benthal decomposition of adsorbed octadecane and the overall oxygen uptake to the benthal deposit. It was found that: decomposition of suspended octadecane proceeds at a rate about 1.10 that of sewage; benthal oxygen uptake rate is a function of initial seed volatile concentration at the deposit surface; the effect of flow rate is partly attributed to the base activity of the deposits and partly to the adsorbed octadecane on the nature of the deposit-water interface; low nitrogen levels inhibit benthal oxygen uptake but low phosphorus levels do not; and both the benthal oxygen uptake rate at constant flow and the effect of flow rate on uptake rate are functions of the reciprocal surface area of confined deposits. (Prague-FIRL)

W75-10260

### 5D. Waste Treatment Processes

#### DESALTING PLANTS INVENTORY, REPORT NO. 5,

Hawaii Univ., Honolulu. Coll. of Business Administration.

For primary bibliographic entry see Field 3A.

W75-09852

#### TREATABILITY OF TEXTILE-DOMESTIC WASTE MIXTURES,

Auburn Univ., Ala. Dept. of Civil Engineering.

J. F. Judkins, Jr.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 561, \$4.75 in paper copy, \$2.25 in microfiche. Alabama Water Resources Research Institute, Auburn, Bulletin 23, February 1975. 86 p, 20 fig, 7 tab, 39 ref.

Descriptors: \*Waste water treatment, Biological treatment, Activated sludge, \*Domestic wastes, Recycling, Alkalinity, Kinetics, Mixing, Temperature.

Identifiers: \*Textile wastes, Activated sludge treatment, Textile-domestic wastes mixtures, Joint treatment.

Qualitative and quantitative treatability information was obtained on highly alkaline mixtures of textile and domestic waste without pH adjustment. Mixture ratios, detention time, rate of solids recycle, and temperature effects were investigated. The kinetic coefficients were determined for three textile-domestic waste mixtures which used textile waste from a single uniform batch. The maximum specific growth rate did not vary significantly for changes in textile-domestic waste mixture ratios within a given textile batch. In general the saturation constant (K<sub>s</sub>), yield coefficient (Y), and decay constant (K<sub>d</sub>) increased as percentages of textile waste in the mixture increased. At a given mixture ratio as temperature increased from 15 to 30C, maximum specific growth rate increased, K<sub>s</sub> decreased, Y increased, and K<sub>d</sub> remained constant. In order to predict the effect of temperature change on the kinetic coefficients, values of Oc for the van't Hoff-Arrhenius relationship were determined for 10:90 and 25:75 textile domestic waste mixtures. At a given temperature as the percentage of textile waste in the mixture increased from 10 percent to 25 percent maximum specific growth rate, K<sub>s</sub> and K<sub>d</sub> increased.  
W75-09859

#### MEANS FOR AND METHOD OF PURIFYING CONTAMINATED WATER,

For primary bibliographic entry see Field 3A.

W75-09864

#### WASTE WATER TREATMENT PLANT WITH BALANCED LOAD,

Kappe Associates, Inc., Rockville, Md. (assignee).

S. E. Kappe, and D. C. Heil.

U S Patent No 3,886,065, 3 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 934, No 4, p 1592, May 27, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Waste water disposal, Water levels, Flow control, Flow augmentation, Water storage, Storage tanks.

A waste water treatment plant is described that receives waste water at a widely fluctuating flow rate and discharges the treated water at a much more uniform, balanced or averaged flow rate. The aeration and clarification tanks themselves are used to store the excess at peak loads at a higher water level; and a conduit that discharges from the clarification tank has metering openings to restrict the discharge of liquid from the clarifi-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

cation tank. Thus the liquid level in the aeration and clarification tanks will rise or fall with fluctuations in waste flow to the treatment plant; but the treated water will leave the plant at a much more uniform flow rate. (Sinha-OEIS)  
W75-09867

#### SEWAGE DISPOSAL SYSTEM,

R. E. Eron.  
U.S. Patent No 3,886,068, 7 p, 9 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 934, No 4, p 1592, May 27, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Foam fractionation, \*Foam separation, Separation techniques, Filtration, Aeration, Water pollution treatment.

A system for treating sewage is described in which a number of interconnected stations, in combination, treat both liquid and solid sewage to produce a mat-like residue, useful as fertilizer, mulch, or ground cover and potable effluent. Raw sewage is fed into a slurry where waste solids are broken down into small particles and treated with chemicals to disinfect, discolor and deodorize it. It is then fed to a foam generator which generates the slurry into an odorless foam. This foam is pumped to a drain facility where the foam is accumulated and the effluent separated from it via a fine wire mesh continuous conveyor through which the effluent is drained or filtered leaving a mat-like residue which is removed from the conveyor into containers. The effluent drains into a reservoir including aerator means which aerate the effluent, after which it is fed into a drain. (Sinha-OEIS)  
W75-09869

#### SEWAGE AND EFFLUENT TREATING SYSTEM,

R. P. Britz.  
U.S. Patent No 3,886,073, 4 p, 8 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 934, No 4, p 1594, May 27, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Water pollution treatment, Separation techniques, \*Flocculation, Filtration, Baffles.

Effluent is pumped from the primary sewage treatment location through a module at which time a flocculating agent is introduced into the sewage. The sewage and flocculent are agitated and thoroughly mixed in this module and it then passes to a retention of flocculent module at which time the majority of the flocculated material is separated out by baffles. The deflocculated effluent then passes to conventional first and second stage filtering tanks. Means are provided to back flow the modules to remove the flocculated material and cleanse the modules when necessary. (Sinha-OEIS)  
W75-09870

#### PROCESS FOR TREATING WATER,

Economic Development Corp., Newfane, Vt. (assignee)  
M. E. McLaughlin.  
U.S. Patent No 3,887,459, 11 p, 4 fig, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 293, June 3, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution control, \*Sewage treatment, Thermal pollution, Powerplants, Cooling, Aeration, Mixing, Waves(Water), Turbulence. Identifiers: Translatory waves.

The invention pertains to cooling water effluent from power generation stations to prevent thermal pollution of natural bodies of water and in another embodiment pertains to a more efficient method of aerating and treating sewage. A process is described for treating a body of water to cool and

to increase the dissolved oxygen content of the water by producing controlled translatory waves in the body of water. The process includes storing water in a reservoir at a selected height above the level of the body of water, periodically releasing specified quantities of water from the reservoir at a point below the level and in an upward direction toward the surface and into the body of water. The upward direction of the released water is accomplished by releasing the water against a deflector located near the base of the reservoir. The released water forms a translatory wave in the body of water and as it moves away from the reservoir, it breaks causing effective mixing of air and water, cooling the water and increasing the oxygen content of the water. The translatory wave produced is referred to as a plunger breaker type. In this type of wave, the waves curl over in breaking enclosing an air pocket which explodes during the breaking process. This action accomplishes excellent mixing of air and water and where solid particles are present, breaking and pulverizing of the particles. (Sinha-OEIS)  
W75-09874

#### MAKING ACTIVE CARBON FROM SEWAGE SLUDGE,

Combustion Engineering, Inc., Windsor, Conn. (assignee)  
R. D. Nickerson, and H. C. Messman.  
U.S. Patent No 3,887,461, 3 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 293, June 3, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, Waste disposal, Separation techniques, \*Activated carbon, Adsorption, Water pollution treatment.

Identifiers: Pyrolytic treatment.

Sewage is subjected to primary treatment which includes allowing solids to settle out in a settling tank, and conveying the solids to a drier where they are at least partially dried by hot gases. The sewage water moves on to a subsequent treatment tank where it can be treated with further additives. The solids are subjected to pyrolytic treatment in a furnace at temperatures within the range of 500 deg C-1000 deg C by passing a stream of hot gases through it. Active carbon and char are formed. The active carbon is separated from the char by entraining it in the gases leaving the furnace. The gases discharged from a fluidized bed pass through a wet scrubber where the fine carbon particles carried along in the gas stream are separated out. The separated carbon particles are relatively pure active carbon. The carbon slurry is recycled to the sewage system to absorb impurities from the sewage and to improve the quality of primary effluent. (Sinha-OEIS)  
W75-09875

#### METHOD FOR PURIFYING WASTE WATER,

T. Minegishi.  
U.S. Patent No 3,888,751, 4 p, 6 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 935, No 2, p 721, June 10, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Water purification, \*Water pollution control, \*Electrolysis, Industrial wastes, Coagulation, Flocculation, Filtration, Separation techniques.

A method and device is described for purifying waste water by subjecting the water to a localized water electrolysis for the promotion of the flocculation of the solid waste material and its subsequent removal. Electrodes are positioned within a tubular member located within a vessel containing the waste water and the waste water is introduced into an electrolysis area located between two spaced electrodes which are subjected to a direct current potential. The incoming waste water is subjected to the action of the newly formed oxygen and hydrogen of the electrolysis process to cause a formation of nuclei which creates the floc-

culation or coagulation of the waste materials so that they are quickly separated from the water. The inorganic particles which are present in the waste water, particularly protein starch powder, fat, heavy metal, etc are coagulated so as to form separable balls of the material which may be made to float on the water surface of the vessel and which may be easily separated from the purified water and collected. (Sinha-OEIS)  
W75-09882

#### SEWAGE TREATMENT TANK,

P. D'Arion.  
U.S. Patent No 3,888,767, 3 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 935, No 2, p 726, June 10, 1975.

Descriptors: \*Patents, \*Waste water treatment, \*Water pollution treatment, Sewage treatment, \*Aerobic treatment, \*Anaerobic digestion, Aeration, Septic tanks, Water pollution sources. Identifiers: \*Sewage treatment tanks.

The invention relates to a sewage treatment tank for the treatment of sewage from houses, hotels, garages, schools, and small industries where normal sewage collector systems do not exist. The sewage tank contains no mechanically moving parts and is composed of two adjacent compartments. In the first compartment most of the solids are separated from the liquids and are digested by anaerobes. The effluent passes to the second compartment where it is submitted to the action of aerobes in the presence of injected air. There is a pipe in each compartment adjacent to the wall separating the compartments. These pipes contain a plurality of holes in their upper portion which permits the continuous evacuation of gases produced in both the compartments. Both pipes also permit the removal of digested sediments from the compartments through the base of the pipes at predetermined intervals. The tanks may be made of many materials. Wood rendered impervious or plastics are both satisfactory materials. (Sinha-OEIS)  
W75-09883

#### APPARATUS FOR TREATING WATER CONTAINING IMPURITIES,

Stanley Denki Kabushiki Kaisha, Tokyo (Japan); and Kabushiki Kaisha Inoue Japan Kenkyusho, Kanagawa (Japan). (assignees)  
T. Techima, T. Nagasao, M. Tanaka, K. Ariga, and K. Inoue.

U.S. Patent No 3,888,756, 5 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 935, No 2, p 723, June 10, 1975.

Descriptors: \*Patents, \*Water purification, \*Water pollution treatment, Water quality control, Demineralization, Industrial wastes, \*Electrolysis, Electrodes, \*Waste water treatment, Water treatment.

An apparatus is provided for treating drinking water or waste water containing impurities by the use of an electrolytic cell. The apparatus contains at least one pair of main electrodes opposed in the electrolytic cell to each other; a power source connected to the main electrodes; and a number of auxiliary electrodes placed in pieces between the main electrodes. The auxiliary electrodes are uniformly arranged in a mutually close relationship but insulated by nonconductive materials between the main electrodes so as to avoid any short circuit between the main electrodes. The nonconductive materials are placed in pieces so as to form a mixed filler layer together with the auxiliary electrodes. The nonconductive materials may be porous plastic holders. (Sinha-OEIS)  
W75-09884

#### REVIEW OF LITERATURE PERTINENT TO THE AQUEOUS CONVERSION OF RADIONUCLIDES TO INSOLUBLE SILICATES

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

WITH SELECTED REFERENCES AND BIBLIOGRAPHY (REVISED),  
Atlantic Richfield Hanford Co., Richland, Wash.  
L. E. Brownell, C. H. Kindle, and T. L. Theis.  
Available from NTIS, Springfield, Va. 22161, as  
Rept. No. ARH-2731 (Rev.), \$5.45 in paper copy,  
\$2.25 in microfiche. Rept. No. ARH-2731  
(Revised), December 1973. 119 p, 4 tab, 267 ref.

Descriptors: \*Bibliographies, \*Radioactive waste disposal, \*Waste treatment, \*Management, \*Waste storage, Clays, Soils, Hydrothermal studies, Ion exchange, Cation exchange, Chemical reactions, Technology, Research and development, \*Reviews.

Identifiers: Solidification, \*Waste fixation.

Radioactive waste fission products and residual actinides in chemical processing plant wastes need to be isolated from biological processes until the radionuclides decay to innocuous levels. A promising method for effecting isolation is to convert the wastes to a highly insoluble material for final storage. The product should be inert for maximum immobility regardless of storage mode during the long-term and any interim storage. Naturally-occurring systems that may yield suitable product forms are the aluminosilicate mineral groups which form much of the earth's crust. Methods being investigated convert nuclear waste into crystalline aluminosilicate minerals wherein each of the nuclide cations are contained within individual molecular cages that constitute the crystal lattices. The literature pertinent to immobilization of cations by silicates, with emphasis on aqueous systems, was reviewed. This report summarizes the literature and includes a bibliography of about 600 references to assist other investigators. References are classified under the following groups: Clay materials, Structure, Technology and Chemistry, Absorption and Ion exchange, Cation Exchange, Fixation, and Diagenesis.

W75-09892

FAUNAL RESPONSE TO SPRAY IRRIGATION OF CHLORINATED SEWAGE EFFLUENT, Pennsylvania State Univ., University Park. School of Forest Resources.

G. W. Wood, P. J. Glantz, D. C. Kradel, and H. Rothenbacher.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 678, \$4.75 in paper copy, \$2.25 in microfiche. Pennsylvania Institute for Research on Land and Water Resources University Park Research Publication No. 87, June 1975. 89 p, 41 tab, 5 fig, 74 ref, append. OWRT B-059-PA(5). 14-31-0001-3932.

Descriptors: \*Sewage effluents, \*Irrigated land, Sludge, Wildlife, Mammals, Birds, E. coli, Mosquitoes, Song birds, Deer, Habitats, Microbiology, Chlorination, Water reuse, Recycling, Water pollution effects.

Identifiers: \*Waste water irrigation, \*Cottontail rabbit, Non-irrigated land, Sludge-injected effluent, Tissues analysis, Microbiological examination, Spray irrigation.

The only significant difference found in a 3-year comparison of cottontail rabbit populations confined to non-irrigated and sewage effluent irrigated aspen-white pineshrub habitat was in the significantly heavier body weights in the fall of juveniles on irrigated sites. Comparisons of spring and fall populations of mice in non-irrigated, effluent irrigated, and sludge-injected effluent irrigated mixed-oak forest habitat were made. Analyses of liver, kidney and bone tissues for cadmium, chromium, copper, nickel, lead and zinc were done on cottontail rabbits from effluent irrigated and non-irrigated sites. Whole-body analyses of dry ashed white-footed mice carcasses for chromium, nickel, lead, and zinc were also made. Studies of the effects of effluent irrigation on production, nutritive quality, and use of deer forages in mixed-oak forest stands were done. Studies of songbirds revealed that their use of irrigated areas declined

during the time of irrigation. A limited investigation of the influence of wastewater irrigation on disease incidence in several species of wild animals was done. Microbiological examination of the wastewater for total coliform, fecal coliform and fecal streptococci was done. (Sink-Penn State) W75-09899

WATER CHLORINATION METHODS, Capital Controls Co., Inc., Colmar. For primary bibliographic entry see Field 5F. W75-09910

ADVANCES IN AMMONIA AND NITRATE REMOVAL, Dravo Corp., Pittsburgh, Pa.

E. S. Savage.

Industrial Water Engineering, Vol 11, No 4, p 12-16, July/August, 1974. 8 fig.

Descriptors: \*Nitrogen, \*Ammonia, \*Industrial wastes, \*Municipal wastes, \*Waste water treatment, Toxicity, Eutrophication, Chlorine, Corrosion, Biological treatment, Denitrification, Microorganisms, \*Nitrates.

Identifiers: Dravo Denite System.

Nitrogen present in industrial and municipal effluents can cause problems of toxicity, oxygen sag, eutrophication, chlorine demand, and corrosivity. Biological reduction of nitrates commonly occurs in waste treatment plants as a result of the action of facultative microorganisms which utilize oxygen from nitrates when the dissolved oxygen levels are too low. This naturally occurring process can be controlled and optimized for biological denitrification systems. Columnar denitrification, one type of system, is characterized by the fixed positioning of denitrifying bacteria in a packed column. Denitrification and suspended solids removal can be accomplished simultaneously in the same equipment. However, fouling of the denitrification filters and breakthrough of nitrate into the effluent at peak hydraulic rates or during low temperatures can also occur. The Dravo Denite System is described; the main components are the filter bottom, media, and control system. Its filter hardware can accommodate high loadings of suspended solids without excessive head loss and can backwash the high loadings from the filter without gradual fouling of the media and control system. The M-block filter bottom has inherent advantages in design, installation, and operation. Selection of the proper denitrification media depends on size, uniformity, density, and hardness. Automatic operation of the control system is recommended for the nitrogen purge cycle and for filter backwashing. The other controls should be as simple as possible without losing reliability and performance. (Orr-FIRL) W75-09911

CARBON CONTACT-FILTRATION: HOW IT WORKS, Seelye, Stevenson, Value, and Knecht, New York.

C. R. Lee, and T. Takamatsu.

Water and Sewage Works, Vol 121, No 8, p 84-87, August 1974. 9 fig, 1 tab, 20 ref.

Descriptors: \*Activated carbon, \*Waste water treatment, \*Adsorption, \*Tertiary treatment, Costs, Mathematical models, Chemical reactions, Separation techniques, Capital costs, Operating costs, Construction costs, Cost analysis, Cost comparisons, Maintenance costs.

Activated carbon treatment is used to remove dissolved organics or inorganics. The mechanism of removal can be adsorption which actually removes the dissolved organics from the solution and/or bio-oxidation of the adsorbed organics. The mechanism of adsorption is discussed. Physical adsorption results from inter-molecular forces of attraction. Chemical adsorption results from the

formation of chemical bonds between the molecules of the adsorbate and adsorbent. The adsorption equilibrium depends on the concentration of the materials, gas pressure, and temperature. Equations developed by Freundlich and Langmuir are presented. The theory of contact-filtration is also discussed. Three modes are considered—single-stage system, multi-stage current flow system, and multi-stage counter-current flow system. Waste treatment cost is classified into two groups: capital cost including construction, land, engineering and contingency; and, operation and maintenance cost including fuel, power, maintenance materials and labor. When considering carbon treatment costs, carbon inventory is included in the capital cost and the make-up carbon and carbon regeneration costs are included in the operation and maintenance cost. A cost analysis is presented for the actual expenses for carbon treatment incurred at a South Tahoe, Nevada, water reclamation plant during 1969 and 1970. Equations, figures, and graphs are used to illustrate expenses and comparisons of costs. (Orr-FIRL) W75-09912

CHARACTERIZATION OF MIXING IN AERATED LAGOONS, McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.

K. L. Murphy, and A. W. Wilson.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 100, No EES, p 1105-1117, October 1974. 7 fig, 2 tab, 18 ref.

Descriptors: \*Aerated lagoons, \*Waste water treatment, \*Mixing, Mathematical models, Aeration, Oxygenation, Sewage treatment, \*Oxidation lagoons.

Identifiers: Continuous Stirred Tank Reactor, Plug Flow Tubular Reactor.

Aerated lagoons have evolved from waste stabilization pond design as economical methods for secondary treatment of large volumes of waste. A rational approach for use in characterizing the mixing behavior of aerated lagoons is presented. It is generally assumed that an aerated lagoon behaves like a completely mixed reactor. The two idealized mixing extremes are the Plug Flow Tubular Reactor (PFTTR), a hypothetical vessel where the fluid enters at one end and moves down the vessel in uniform piston-like flow to the exit and the Continuous Stirred Tank Reactor (CSTR) where mixing is so intense that no concentration gradients exist and the concentration of the exit stream is equal to the concentration at any point in the vessel. Variations of these models and others were fitted to tracer data taken from prototype aerated lagoons. The following conclusions were drawn from an analysis of the experimental data: mixing patterns in aerated lagoons may differ significantly from the assumptions of either ideal complete mixing or ideal plug flow; macromixing levels in aerated lagoons are more dependent upon lagoon geometry than upon aerator horsepower input over the range studied; dimensionless dispersion number which characterizes the degree of macromixing depends only on the lagoon geometry and flow rate; and the overall performance of aerated lagoons may be evaluated using the relatively simple unequally-sized CSTR-in-series model. (Orr-FIRL) W75-09913

SEWAGE PLAN WEDS FIVE MUNICIPALITIES, Parsons, Brinckerhoff, Quade and Douglas, Inc., New York.

H. L. Michel, and J. V. Artale.

Water and Wastes Engineering, Vol 11, No 9, p 28-31, September 1974. 3 fig.

Descriptors: \*Waste water treatment, \*Sewage disposal, \*Sewage treatment, Municipal wastes, Pumping plants, Sewerage, Trickling filters,

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

Biological treatment, Sewage lagoons, Chlorination, New Jersey, \*Treatment facilities.

The five municipalities of Hamilton Township, West Windsor Township, Washington Township, Borough of Allentown, and part of the Township of Upper Freehold, all in the central part of New Jersey, have joined together in a sewage disposal master plan. The plan is technically, economically, financially, and administratively attractive and is designed to provide service for anticipated needs fifty years from today. Two stage expansion of the existing water treatment plant in Hamilton Township is planned. The first stage would include a new high-rate trickling filter section for secondary biological treatment, additional digested sludge lagoons, improvements to the post-chlorination facilities and the recirculation pumping system in one section of secondary treatment, construction of 12 miles of interceptor sewers, 3 pumping stations and 4 miles of force mains, and a pumping station and force main to transport the treated effluent directly to the Delaware River, about one mile from the main treatment plant. The expansion will increase the capacity of the plant to 11 mgd. The second stage of improving the waste water treatment includes a further expansion of the treatment plant capacity to 30 mgd, an increase in pumping capacity, and the construction of five more major interceptors. The system is expected to be completed by 1990. (Orr-FIRL)  
W75-09914

#### AN ANALYSIS OF RUNOFF IN AN URBAN AREA (IN JAPANESE), Y. Mori.

Chiba Kogyo Daigaku Kenkyu Hokoku, (Research Report of Chiba Institute of Technology), No 19, p 133-137, 1974. 3 fig, 4 ref.

Descriptors: \*Rainfall, \*Sewage treatment, \*Municipal water, \*Runoff, Precipitation(Atmospheric), Analytical techniques, Rainfall intensity, \*Urban runoff, Cities.  
Identifiers: Mannings law, \*Tokyo(Japan).

Amounts of effective rainfall entering a sewage channel in the Tokyo area were calculated and compared with observed values. The sewage channel selected is 4300 km long and its surrounding area is considered to be 6.2 sq km. Market and residential areas are located at the upper stream of the channel; industrial and business areas are located at the lower stream. Types of rainfall are divided into eleven categories based on the rainfall intensity and rainfall period. No clear relationship between effective rainfall and rainfall type was observed. In all cases, the rainfall runoff to the sewage channel was completed within one hour after the precipitation stopped. The effective rainfall increased with an increase in the rainfall intensity. The calculation used basic equations for the runoff curve, assuming Mannings law. (Katayama-FIRL)  
W75-09916

#### BIODEGRADATION OF NTA DETERGENTS IN A WASTEWATER TREATMENT SYSTEM, Johns Hopkins Univ., Baltimore, Md.

C. E. Renn.

Journal Water Pollution Control Federation, Vol 46, No 10, p 2362-2371, October 1974. 3 fig, 2 tab, 8 ref.

Descriptors: \*Waste water treatment, \*Detergents, \*Phosphates, \*Domestic wastes, \*Nitrilotriacetic acid, Water pollution sources.  
Identifiers: \*Trisodium nitriloacetate, NTA.

A practical field test was performed to determine the biodegradability of trisodium nitrilotriacetate (NTA) in a domestic waste water treatment system. The test was conducted over a three year period at the Elm Farm Mobile Home Park near Woodbridge, Va. The waste water treatment plant consisted of a 25,000 gallon mixed liquor basin.

aerated and mixed by an aerator driven by two 2.5 hp compressors. The mixed liquor is displaced to a conical clarifier through a submerged line to the clarifier's stilling well. The treated waste water is released to a stream; the waste sludge is disposed of on tilled land. The first release of the detergent to the community resulted in two findings: the total phosphorus in the treated waste water dropped from 18 to 20 mg/liter to 10 mg/liter in the first week and continued downward through the following weeks to a steady low of around 8 mg/liter; and, the community used much more of the detergent than was expected. The initial results indicated that the plant was unable to acclimate itself to shock concentrations of NTA. The detergent was again released to the community and the phosphorus and NTA levels were monitored. The results of this part of the study indicated that the plant influents had acclimated to 40 mg/liter NTA and consistently yielded effluents in the range of 0.3 to 1.0 mg/liter NTA. Good performance of the system was also shown by MBAS concentrations of less than 0.5 mg/liter and DOC reductions of 70 percent in the effluent. (Orr-FIRL)  
W75-09920

#### BIOLOGICAL PURIFICATION OF WASTE WATER AND SEWAGE.

French Patent 11433W/07. Issued December 20, 1974. Derwent French Patents Report, Vol W, No 7, p 3, March 25, 1975.

Descriptors: \*Waste water treatment, \*Patents, \*Biological treatment, \*Sewage treatment, Oxidation, Sludge treatment, Aeration, Aerobic treatment, Bacteria, Treatment facilities.  
Identifiers: Extended aeration.

A biological treatment process for waste water and sewage coming from small and medium sized communities involves total oxidation (extended aeration). Crude effluent is admitted directly into an oxidation-settlement tank which is equipped with a floating turbine to stir and homogenize the medium with an intense introduction of oxygen. This causes direct oxidation, allowing aerobic bacteria to live and multiply. After the aeration phase, the turbine is stopped and settlement takes place. The sludge falls to the bottom and the upper layer rapidly becomes limpid; it is evacuated through an automatic overflow valve. After the evacuation of the purified water, the valve closes and the plant may begin another cycle. (Prague-FIRL)  
W75-09921

#### AERATING EFFLUENT AND KEEPING SLUDGE IN SUSPENSION.

French Patent 57251V/32. Issued September 27, 1974. Derwent French Patents Report, Vol 47, No 5, p 3, December 31, 1974.

Descriptors: \*Patents, Aeration, Effluents, Suspensions, Sludge, Jets, Waste water treatment, Flow, Activated sludge.

Effluent is aerated and activated sludge is held in suspension by jets of water obliquely striking the surface. The vessel used may be circular, elliptical or polygonal in plan and is of constant cross-section through the greater part of its height. Jets strike the surface at not more than 60 degrees, preferably 10 to 20 degrees to the surface with a speed of between 3 to 12 m/sec (preferably 4 to 8 m/sec). The horizontal component of the tangent is in the general direction of the flow. (Prague FIRL)  
W75-09922

#### WATER TREATMENT WITH OZONE.

For primary bibliographic entry see Field 5F.  
W75-09923

#### SEWAGE AND EFFLUENT BIOLOGICAL TREATMENT PROCESS.

Belgian Patent 82653V/48. Issued November 4, 1974. Derwent Belgian Patents Report, Vol 5, No 48, p 2, January 7, 1975.

Descriptors: \*Sewage treatment, \*Patents, \*Oxygen, Biological treatment, Effluents, Valves, \*Waste water treatment, Liquids, Tanks, Separation, \*Oxygenation.  
Identifiers: Countercurrents.

A sewage and effluent biological treatment process uses oxygen in counter-current flow with liquid containing suspended oxidizable matter. The plant facility is designed for activated sludge treatment of sewage, industrial effluents and fermentation liquors. Liquid to be treated enters a series of covered oxygenation tanks; these communicate with each other through openings in the separating partitions. Automatic valves control the oxygen content of the gaseous phase, held at a predetermined value. Oxygen or air enriched with oxygen circulates counter-current to the liquid. The treated liquid leaves the last tank to pass into a separating tank from which the settled sludge is recycled back to the first tank. With regular oxygen feed into the various tanks, better operating conditions result: consumption of oxygen is reduced; the energy balance is improved; and the dimensions of the settlement tank can be reduced. (Prague-FIRL)  
W75-09924

#### BIBLIOGRAPHY ON THE APPLICATION OF REVERSE OSMOSIS TO INDUSTRIAL AND MUNICIPAL WASTEWATERS.

Department of the Environment, Ottawa (Ontario). Waste Water Technology Centre. H. K. Johnston, and H. S. Lim.

Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 18, (1973). 117 p, 5 fig, 1 tab, 730 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Reverse osmosis, \*Membrane processes, \*Municipal wastes, Membranes, \*Bibliographies, Filtration.  
Identifiers: \*Ultrafiltration.

A bibliography has been developed of the literature published in the period 1968-1973, inclusive, on the various applications of reverse osmosis. The references presented emphasize the use of reverse osmosis for the treatment of industrial and municipal waste waters. The introduction provides information on the physical-chemical nature, theories, and mechanisms of the reverse osmosis process. Membrane properties, fabrication, and configurations for different applications are discussed in addition to various membrane cleaning techniques. A list of companies selling commercial reverse osmosis or ultrafiltration equipment is also included. (Orr-FIRL)  
W75-09925

#### REVIEW OF THE CANADIAN METAL FINISHING INDUSTRY: CONSUMPTION OF RAW MATERIALS AND OPTIONS FOR WATER POLLUTION CONTROL.

Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate. Economic and Technical Review Report No. EPS 3-WP-75-2, March 1975. 151 p, 6 fig, 24 tab, 11 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, Reviews, Water pollution control, Water reuse, \*Canada, Metals, Legislation, Pollution abatement.  
Identifiers: \*Metal finishing industry, Chemical recovery, Metal recovery, Cyanide removal.

A review is presented of the processes used in the Canadian metal finishing industry, its waste products, and waste reduction processes. Background information is organized into various

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

sections dealing with: the mechanical, physical, non-metallic coating, chemical, and electrolytic processes, and waste water constituents; the results of a survey of the metal finishing industry; water pollution prevention practices such as substitution, water use, control of accidental spills and leaks, drag-out and drainage, reclamation, regeneration, solution concentration, and supervision; in-plant water pollution control techniques such as stream separation, water reuse, recovery of chemicals and metals, and concentrated dumps; removal of cyanide and chromium as well as other metals; and, existing Canadian legislation. (Orr-FIRL)  
W75-09926

**FREEZE CRYSTALLIZATION: NEW WATER PROCESSING TOOL,**  
N. R. Iammartino.  
Chemical Engineering, Vol 82, No 13, p 92-93, June 23, 1975. 2 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, Cooling towers, Pulp and paper industry, Water reuse, Potable water, Costs, Water purification.  
Identifiers: \*Freeze-crystallization, \*Crystalex process, Electroplating wastes.

The Crystalex process has been developed by Avco Systems Division for use in purifying a wide range of industrial wastes such as electroplating wastes, cooling-tower blowdown, pulp mill bleach streams, and various inorganic and organic waste streams. The Crystalex process is a freeze-crystallization technique based on the principle that ice crystals formed by freezing in an aqueous medium are always pure. The mechanics of the process plus a schematic illustration are discussed. The Crystalex process can recover up to 95 percent of the influent as pure water for reuse. Production of potable water and recovery of valuable products are other uses of this process. Advantages of the process include: minimization of corrosion problems and construction materials cost by running at low temperatures and avoiding heat-transfer surfaces in the crystallization stage; elimination of costly pretreatment; consumption of a modest amount of energy; and, production of a high water recovery ratio. The installed cost of a 100,000 gal/day crystalex module is estimated at \$400,000-650,000; significant economies of scale exist. (Orr-FIRL)  
W75-09927

**JOINT TREATMENT OF PULPING AND MUNICIPAL WASTES,**  
Procter and Gamble Co., Cincinnati, Ohio. Environmental Control Section.  
C. A. Barton, J. F. Byrd, C. R. Faulkender, and O. H. Moss.  
Journal Water Pollution Control Federation, Vol 47, No 5, p 998-1004, May 1975. 1 fig, 3 tab, 4 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Municipal wastes, \*Activated sludge, Cost allocation, Pulp and paper industry, Effluent, Treatment facilities, Wisconsin.  
Identifiers: \*Contact stabilization, Green Bay (Wisc), \*Combined treatment.

The City of Green Bay, Wisconsin, the Charmin Paper Products Company, and the American Can Company are involved in the construction of a \$60 million treatment plant for their combined wastes. The plant will be an activated sludge facility utilizing contact stabilization. It will be ready for startup in 1975. The cooperation between the city, the mills, and the Green Bay Metropolitan Sewerage District in developing the contracts and financial arrangements for the joint treatment system is described. The rate structure, or cost allocation, was developed to depend on each mill's flow, BOD, and SS load. The final rate each year will reflect actual load as developed from the annual audit of the District's financial records. Basically,

the contract between the city, the mills and the district states that the District will provide adequate treatment of the pulp mill effluent, the city will collect the sewer service charges, and the individual mills will pay their share of the operating costs based on actual loads and their share of the capital cost based on the design loads. (Orr-FIRL)  
W75-09928

**MUNICIPALITY AND INDUSTRY JOIN IN WASTEWATER TREATMENT.**  
Public Works, Vol 106, No 5, p 89-90, May 1975. 2 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, Pulp and paper industry, \*Municipal wastes, Activated sludge, Filters, Incineration, Cost allocation, Cities, Treatment facilities, Sludge, Ohio.  
Identifiers: Hamilton (Ohio), Champion International, Paper mills, Vacuum filters, Fluid bed incinerator, \*Combined treatment.

The City of Hamilton, Ohio, and the nearby paper mills of the Ohio Division of Champion International are constructing a waste water treatment facility for their combined wastes. The joint plant represents major savings in capital investment and operating costs for both the city and company. The facility will be an activated sludge plant consisting of aeration tanks and final clarifiers, with effluent aeration and five vacuum filters for dewatering the city's primary sludges, plus all secondary sludges generated, followed by incineration of the sludges in a fluid bed incinerator. The completed plant will be able to process 72,000 lbs dry solids per day and a maximum anticipated 1985 peak load of 32 mgd of waste water. Capital costs will be based on flow, BOD loading, sludge loading and an average weight factor of associated capital costs. Operating costs will be based on the actual loads. The present projected construction cost is \$13 million; the completion date is late 1976. (Orr-FIRL)  
W75-09929

**VACUUMING WASTE FROM WATER.**  
American Machinist, Vol 119, No 11, p 52, June 1975.

Descriptors: \*Waste water treatment, \*Industrial wastes, Treatment facilities, Coolants, \*Filters, Sludge disposal, Rivers, Landfills, Effluents, Dewatering, Equipment, \*Filtration, Illinois, Separation techniques.  
Identifiers: \*Vacu-matic sludge filters, Oil-sludge particles, Chemical treatment.

International Harvester's East Moline, Illinois plant has recently installed a \$500,000 waste water treatment facility. The facility treats contaminated machine coolant and other liquids, separating the filtered water which is pumped into the river from the sludge waste which is disposed of in a landfill. The contaminated water comes from a variety of machines and processes including lathes, drilling machines, paint preparation area, milling and hobbing equipment, saws and cutoff machines, and wash booths. The waste water is first channeled to large underground collection tanks. It is then piped to two settling tanks where floating oil-sludge particles are skimmed from the surface. The effluent is transferred to a floatation tank where chemicals are added and the resultant sludge is skimmed and dewatered for hauling. Chemical treatment consists of the addition of lime, alum, and an anionic polyelectrolyte. Dewatering of the sludge is accomplished with the aid of a Vacu-matic sludge filter. The sludge filter has a relatively large filtering zone for effective sludge cake generation. The filtering media does not have to be separated from the sludge because it is made of paper and decomposes in the landfill. The installation is capable of processing 54,000 gal of contaminated liquid every 24 hours. (Orr-FIRL)  
W75-09930

**POLLUTION ABATEMENT IN THE PHARMACEUTICAL INDUSTRY,**  
National Environmental Research Center, Edison, N.J. Industrial Waste Treatment Research Lab.  
P. B. Lederman, H. S. Skovronek, and P. E. DesRosiers.

Chemical Engineering Progress, Vol 71, No 4, p 93-97, April, 1975. 5 tab, 19 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, Biological treatment, Activated sludge, Aerated lagoons, Trickling filters, Treatment facilities, Adsorption, Reverse osmosis, Filtration, Coagulation, Sedimentation, Chemical wastes, \*Pollution abatement, Organic wastes.  
Identifiers: \*Pharmaceutical wastes, Ozone treatment, Toxic wastes.

Pollution abatement in the pharmaceutical industry is discussed. A summary is presented of a study initiated in 1972 by the Pharmaceutical Manufacturers Association (PMA) to compile information on the sources, volumes, and characteristics of the industry's wastes, current treatment processes, and future treatment needs. The industry's wastes were segregated into: formulation/packaging; chemical synthesis; fermentation; biological products, and, extraction of natural products. Many generalities were made for each of these segments but precise waste volumes, characteristics, or treatability could not be determined. Biological treatment practices are commonly used for both on-site complete treatment, and pre-treatment before discharge to a municipal facility. Activated sludge and aerated lagoons are replacing the trickling filters used in older treatment facilities. The general conclusion is that different biological treatment methods, together with segregation of strong or toxic wastes, neutralization, and conventional coagulation and sedimentation, are capable of obtaining about 90 percent removal of BOD<sub>5</sub> for all types of pharmaceutical wastes. The cost of the waste water treatment was found to range from \$0.76/1000 gal to \$2.27/1000 gal. Future treatment needs include the use of advanced waste water treatment processes such as carbon adsorption, reverse osmosis, ultrafiltration, and ozone treatment, as well as more research on ultimate disposal and/or resource recycling. (Orr-FIRL)  
W75-09931

**RECOVERING ORGANIC MATERIALS FROM WASTEWATER,**  
Rohm and Haas Co., Philadelphia, Pa.  
B. W. Stevens, and J. W. Kerner.  
Chemical Engineering, Vol 82, No 3, p 84-87, February, 1975. 2 fig, 1 tab, 10 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Polymers, Adsorption, \*Chemical wastes, Costs, Activated carbon, Organic compounds, Solvents, \*Organic wastes, Separation techniques.  
Identifiers: \*Pharmaceutical wastes, Nonthermal regeneration, \*Recovery(Organic wastes).

The use of polymeric adsorbents for separating and recovering organic compounds from chemical and pharmaceutical waste waters has been rapidly increasing. Polymeric adsorbents permit non-destructive adsorption, which allows recovery of costly or short-supply products, and nonthermal regeneration, which reduces fuel bills. A comparison of polymeric adsorbents with activated carbon is made. Polymeric adsorbents are good for both polar and nonpolar material, while activated carbon is good only for nonpolar substances. Binding energies of polymeric adsorbents are lower than those of activated carbon for the same organic molecules, thus requiring smaller energy inputs for desorption. Solvent regeneration of polymeric adsorbents is most effective when performed in situ. Careful selection of the solvent will permit the recycling of a regenerant stream laden with an adsorbed organic compound thereby forming a closed-loop, materials-recovery process.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

Capital costs of polymeric adsorbent systems are comparable to those of activated carbon. Operating costs are less for polymeric adsorbent systems than for carbon systems when the concentration of dissolved organics is high. (Orr-FIRL)  
W75-09932

#### TERTIARY TREATMENT: ADVANCED WASTEWATER TECHNIQUES,

R. A. Young, P. N. Cheremisinoff, and S. M.

Feller.

Pollution Engineering, Vol 7, No 4, p 26-33, April, 1975. 7 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Tertiary treatment, Chemical precipitation, Sedimentation, Nutrient removal, Activated carbon, Ion exchange, Chlorination, Reverse osmosis, Electrodialysis, Freezing, Ozone, Foam separation.

Identifiers: Physical-chemical treatment, Ammonia stripping, Ionizing radiation.

Advanced waste water treatment methods can be either chemical or physical processes. There is currently an increasing use of physical-chemical treatment over biological treatment most probably due to physical-chemical treatment's amenability to instrument-automated control, reduced space requirements, better removal of toxic substances such as heavy metals, and ability to adjust to variable influents and upset conditions. Sedimentation, chemical precipitations, phosphorus removal, activated carbon adsorption, ion exchange, ammonia stripping, chlorination, reverse osmosis, electrodialysis, freezing, foam separation, ozonation, and ionizing radiation are all processes used for the tertiary treatment of waste water. (Orr-FIRL)  
W75-09933

#### HEAVY METAL ADSORBENT.

French Patent 01489V/01. Issued March 14, 1975. French Patents Abstracts, Vol W, No 17, p 3, June, 1975.

Descriptors: \*Waste water treatment, \*Industrial wastes, Resins, Heavy metals, \*Patents, \*Adsorption, Construction materials.

Identifiers: \*Heavy metals removal.

An adsorbent resin for the efficient removal of heavy metals or heavy metal compounds in liquids and gases, such as industrial waste water, river water, and automobile exhaust, is prepared by reacting an aldehyde and/or a dithiocarbamate with an aromatic compound having an OH, SH, NH<sub>2</sub>, COOH, or COOMe group, where Me is Na, K NH<sub>4</sub>, or 1/2Ca. It can be used in the form of a granular bed added to materials, such as concrete, which are then used as containers for heavy metal solutions, or for the production of pipes to transport material containing heavy metals. (Orr-FIRL)  
W75-09934

DESTRUCTION OF SPENT OIL-WATER EMULSIONS-USING INCANDESCENT COKE BEFORE QUENCHING, Belgian Patent 22521W/14. Issued March 3, 1975. Derwent Belgian Patents Report, Vol W, No 14, p 1, May, 1975.

Descriptors: \*Waste water treatment, \*Industrial wastes, Metals, \*Patents, Oily water, Emulsions, Oil-water interfaces.

Identifiers: \*Oil-water emulsions, Rolling mills, Surface finishing plants, Coke.

The destruction of spent oil-water emulsions is accomplished by applying the emulsions or residues obtained from such emulsions to the surface of incandescent coke after it has been discharged from an oven but before it has been quenched. The emulsion or its residue is applied from a pipe opening above the surface of the incandescent coke.

This method provides an inexpensive way of disposing of large quantities of oil-water emulsions from metal processing plants such as rolling mills or surface finishing plants. Part of the material may be recovered through this technique. Iron turnings derived from metal processing do not interfere with the process and the metal is recovered when the coke is used in a blast furnace or cupola. The method is successful with residues containing oil in an amount equal to or less than 70 percent. (Orr-FIRL)  
W75-09935

#### MEMBRANE PROCESSING IN THE METAL FINISHING INDUSTRY,

Abscor, Inc., Cambridge, Mass. Walden Research Div.

R. L. Goldsmith.

Transactions of the ASME, Journal of Engineering for Industry, Vol 97, No B-1, p 238-245, February, 1975. 4 fig, 1 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Membrane processes, \*Reverse osmosis, Filtration, Coolants, Effluents, Incineration, Oil, Water reuse, Metals.

Identifiers: \*Metal finishing industry, \*Ultrafiltration, Electropolating wastes, Oily wastes.

Two important applications of membrane processing in the metal finishing industry are the use of reverse osmosis (RO) for electropolating waste treatment, and ultrafiltration (UF) for concentration of oily wastes before disposal. Reverse osmosis can be used for the closed-loop treatment of plating bath rinse waters with recycle of the plating chemicals and reuse of the purified water in rinsing operations. Closed-loop RO for treatment of segregated rinse waters and for treatment of mixed effluents are discussed in detail with reference to the advantages and limitations of each. In the treatment of waste-oil emulsions by UF, water and some low-molecular weight materials pass through the membrane, while the emulsified oil droplets and suspended particles are retained, concentrated, and continuously removed. UF is capable of concentrating emulsions to greater than 50 percent oil. These can be incinerated without the addition of fuel, or the oil can be reused by upgrading it to a fuel or lubricant. Data are presented for the UF concentration of several spent oil-containing coolants. (Orr-FIRL)  
W75-09936

FACTORS INFLUENCING REVERSE OSMOSIS REJECTION OF INORGANIC SOLUTES FROM AQUEOUS SOLUTION, Ford Motor Co., Dearborn, Mich. Scientific Research Staff.

M. E. Heyde, C. R. Peters, and J. E. Anderson. Journal of Colloid and Interface Science, Vol 50, No 3, p 467-487, March, 1975. 5 fig, 7 tab, 65 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Reverse osmosis, \*Membrane processes, Separation techniques, Aqueous solutions.

Identifiers: Cellulose acetate membranes, Partition coefficients, Electrical charge.

The potential use of reverse osmosis in a variety of waste water applications is discussed. The factors influencing reverse osmosis rejection of inorganic solutes from aqueous solution were examined with emphasis on the partition coefficients of inorganic compounds between water and cellulose acetate membranes. Electrical charge is the most important factor governing the cellulose acetate/water partition coefficients of electrolytes. The mean membrane/water partition coefficients of ions decrease with increasing solute charge, and increase with increasing ionic size. The effective charge of a salt does not necessarily correspond to its normal valence. The pH of the external solution alters the concentration of fixed membrane charges by shifting the equilibrium between

ionized and unionized carboxyl groups on the membrane. Ion-pairing with H<sub>3</sub>O<sup>+</sup> or OH<sup>-</sup> changes the effective solute charge. Concentrated salt solutions produce swelling or shrinkage of both homogeneous, fully dense cellulose acetate membranes and the surface skin of asymmetric cellulose acetate films. The membrane/water partition coefficients of electrolytes as well as their reverse osmosis rejection can be correlated with other physical measurements and with the lyotropic series. A comprehensive experimental basis is presented for understanding the mechanism of reverse osmosis rejection by cellulose acetate membranes. The results of this work may be used to predict reverse osmosis behavior under experimental conditions. (Orr-FIRL)  
W75-09937

#### TREATMENT OF AQUEOUS WASTE STREAMS WITH HYDROGEN PEROXIDE TO REMOVE CHLORINATED ISOCYANURATES THEREFROM,

FMC Corp., New York. (assignee).

R. H. Carlson, R. N. Mesiah, and H. R. Chancey. United States Patent 3,878,208. Issued April 15, 1975. Official Gazette of the United States Patent Office, Vol 933, No 3, p 1369, April, 1975.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Patents, Chemical wastes, Pollution abatement, Water pollution control.

Identifiers: \*Chlorinated isocyanurates, Hydrogen peroxide, Dechlorination.

The manufacture of chlorinated isocyanurates results in a waste water stream with a pH from 0.5 to 7.0, containing dissolved chlorinated isocyanurate. A treatment method for such waste streams is described. The streams are treated with hydrogen peroxide at a pH of 0.5 to 12.0. This causes a dechlorination of the contaminating chlorinated isocyanurate. A precipitation and subsequent recovery of the isocyanurate is then effected. (Orr-FIRL)  
W75-09939

#### PROCESS FOR TREATING WASTE PHOTOGRAPHIC PROCESSING SOLUTIONS,

Fuji Photo Film Co., Ltd., Kanagawa (Japan). (assignee)

I. Shimamura, and H. Iwano.

United States Patent 3,869,383. Issued March 4, 1975. Official Gazette of the United States Patent Office, Vol 932, No 1, p 228, March, 1975.

Descriptors: \*Waste water treatment, \*Industrial wastes, Ion exchange, Resins, \*Patents, Chemical wastes, \*Anion exchange.

Identifiers: Photographic processing solutions, Ferricyanides, Buffering compound.

A process is described for the treatment of waste photographic processing solutions containing ferricyanide and/or ferrocyanide ions. The waste solution, pH 7-9, is contacted with a weakly basic anion exchange resin in the free base form in the presence of a buffering compound. The buffering compound is added in an amount sufficient to maintain buffering action at a pH of 7-9. The ferricyanide and ferrocyanide ions are thereby adsorbed on the anion exchange resin. (Orr-FIRL)  
W75-09940

#### FLUIDIZED-BED INCINERATION OF URBAN SLUDGE (INCINERATION DES BOUES URBAINES EN LIT FLUIDISÉ),

M. Tamalet.

Revue Generale de Thermique (Paris), No 150/151, p 511-517, June/July, 1974. 9 fig, 1 tab.

Descriptors: \*Municipal wastes, \*Sludge treatment, Waste water treatment, \*Incineration, Costs, Combustion, Urban drainage, Waste disposal.

Identifiers: \*Fluidized-bed incineration, Urban sewage sludge.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

A method and the equipment for the fluidized-bed incineration of urban sewage sludge are described. A sand fraction of 0.5-2.0 mm is used as a fluidized medium. The sewage sludge is injected at the top of the fluidized-bed reactor to obtain lumps about 20 mm in size which are heated rapidly. The prevention of malodorous emissions requires a minimum reactor temperature of 800 C. Incineration takes place in a temperature range of 800-850 C at an excess-air coefficient of 20 percent. The combustion products are carbon dioxide, water, and mineral ashes. The cost of the incineration increases rapidly with increasing water content in the sludge, as does the flue gas volume. The fluidized-bed sludge incineration is simple, economical and efficient. (Takacs-FIRL) W75-09941

#### ACTIVATED CARBON TREATMENT OF UNBLEACHED KRAFT EFFLUENT FOR REUSE, Saint Regis Paper Co., Pensacola, Fla. Research and Development Center.

E. W. Lang, W. G. Timpe, and R. L. Miller. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 246, \$7.50 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/2-75-004, April 1975. 207 p, 30 fig, 41 tab, 52 ref, 10 append. EPA 1BB037, 12040 EJU.

Descriptors: \*Water reuse, \*Waste water, Treatment, \*Activated carbon, Chemical wastes, Biochemical oxygen demand, \*Industrial wastes, \*Pulp wastes, Cost trends, Pilot plants, Effluents, Calcium carbonate, Tertiary treatment, Lime. Identifiers: Pulp mill effluents, Color removal, \*Unbleached kraft wastewater treatment, Microlime-carbon process, Total organic carbon.

A four-year pilot plant program was carried out to investigate the technical and economic feasibility of treating unbleached kraft pulp and paper mill effluent for reuse. Preliminary laboratory studies and cost estimated indicated that the following treatment sequences should be investigated in the pilot plant: (1) primary clarification, carbon adsorption, (2) lime treatment, carbon adsorption; (3) primary clarification, bio-oxidation, carbon adsorption. Water of reusable quality can be provided from unbleached kraft effluent by several combinations of treatment utilizing activated carbon. Unbleached pulping effluents typically contain about 1000 color units, 250 mg/l TOC, and 250 mg/l BOD. Reusable water quality as defined in this study is 100 color units and 100 mg/l TOC. The most economical treatment is the microlime-carbon process that utilizes low dosages of lime and clarification followed by carbon adsorption in down-flow granular carbon beds. Capital cost for treatment by this process of 9.6 mgd of unbleached kraft effluent from an 800-ton-per-day mill was estimated to be \$6.7 million. Operating costs, inclusive of capital depreciation, were estimated to be \$0.30 per 1000 gal and \$3.58 per pulp-ton, including credit for the reused water. Carbon adsorption in continuous counter-current stirred contactors was found to have promise of lower operating cost and substantially lower capital costs as compared to adsorption in fixed beds. (EPA) W75-10028

#### SOLVENT SOLVES DEWATERING.

Water and Wastes Engineering, Vol 11, No 9, p 84, September 1974.

Descriptors: \*Waste water treatment, \*Sludge treatment, \*Dewatering, \*Separation techniques, \*Solvents, Municipal wastes, Industrial wastes, Solubility, Energy, Costs, Washington. Identifiers: \*Seattle(Wash).

A new process using a solvent for dewatering of municipal and industrial sludge has been developed by the Boeing Aerospace Company of Seattle. It is designed to comply with strict water and air pollution control regulations and will allow

the reclamation of oil and other sludge constituents. A solvent of the aliphatic amine family which becomes completely miscible below 20C is mixed with the sludge. The resulting solution is a mixture of solid particles in a solution of water, solvent, oils, and fats. Solids are removed mechanically; water and solvent are separated by heating the solution to above 40C; and fats and oils are removed from the solvent by distillation. The solid portion is about 96% solid and will gather moisture in a normal atmosphere; the water is clear and sterile; and the oils and fats are of a commercially reclaimable grade. This technique is called the Boeing Extractive Sludge Treatment (BEST) and works equally well with highly organic or inorganic sludges. A theoretical savings of up to 90% in energy could be realized if BEST is used instead of some of the high temperature evaporation drying systems now used. Engineering cost analyses indicate an overall potential savings of 25% to 50% over present sludge dewatering methods. (Orr-FIRL) W75-10037

#### USING SLUDGE, OIL, AND WATER SEPARATION FOR RECYCLING WATER.

Water and Sewage Works, Vol 121, No 11, p 41-42, November 1974.

Descriptors: \*Waste water treatment, \*Separation techniques, \*Reclaimed water, \*Oily water, \*Water reuse, Water treatment, Oil wastes, Sludge, Oil pollution, \*Recycling.

Identifiers: Endress+Hauser's Vibratrol, Oil reclamation.

The treatment and recycling of water, including the reclamation of constituents which can be reused, can be a contributing factor in energy supply and is becoming increasingly important. A system has been designed to reclaim oil and sludge constituents. It is the Endress+Hauser's Vibratrol, a submersible vibrating tuning fork level control. It is an automatically-controlled separator system that can be buried in the ground. The influent is collected and solids, oil and retreable water are separated, reclaimed, totaled and treated continuously. Level control sites are the sludge/water interface, the oil level, the water level and water outflow totalization. The E+H Vibratrol vibrates in air, water, or a similar substance. When the tuning fork is contacted by sludge or solids at a predetermined level, it activates an agitator and pump for reclamation of sand, clay and gravel. The Vibratrol consists of a pair of piezo ceramic crystals mounted permanently within the tuning fork assembly. The piezo-electric principle is applied in a closed loop: power is supplied to a crystal which then oscillates, the oscillation is picked up by the tuning fork, increased to its natural resonant frequency, ending in a sympathetic, harmonic vibration which drives the second crystal to provide power output. (Orr-FIRL) W75-10038

#### CHEMICALS REDUCE SYSTEM ODOURS,

Winnipeg Waterworks, Waste, and Disposal Div. (Manitoba).

A. Penman, and W. J. Borlase. Water and Pollution Control, Vol 113, No 1, p 29, 33, January 1975.

Descriptors: \*Odors, \*Sewage treatment, Municipal wastes, Industrial wastes, Oil industry, \*Canada, Chlorine, Pilot plants, Costs, \*Waste water treatment.

Identifiers: \*Micro-Aid, Winnipeg(Canada).

The sewage system of the City of Winnipeg, Canada accepts wastes from one major oil refinery and three meat packing plants at one of its lift stations. Upstream from the lift station, the combined industrial and municipal wastes have been causing sewer odors. Treatment of these odors in the past has been by chlorination. However, with increas-

ing chlorine costs, possible difficulties in obtaining chlorine, and danger involved in its storage and use, alternative treatment methods have been investigated. In 1974, a product called Micro-Aid was tested over a seven-week period during the hottest summer months. The product is extracted from Yucca plants and consists of 10% natural saponins extracted from plants, 90% inert water, and 150 ppm of copper as a preservative. Five test sites were sampled for atmospheric temperature, sewage temperature, dissolved sulfide, atmospheric sulfide, pH, and general odor. Three periods of study compared Micro-Aid, chlorine, and no odor control treatment. Overall reduction of odors was found with Micro-Aid but chlorine provided better immediate reduction in atmospheric and dissolved sulfide levels. Micro-Aid does not reduce levels of dissolved sulfide within the sewage, but acts as a surfactant, reducing the surface tension of the sewage and keeping the hydrogen sulfide in solution. A one-year trial of this product for 1975 has been proposed. Although its costs are 25% higher than chlorine, operational and safety benefits may warrant its use. (Prague-FIRL) W75-10040

#### HYDRAULIC MODEL STUDY OF A LARGE-CAPACITY SETTLER IN A WATER CAPTURE SYSTEM (BADANIA HYDRAULICZNE MODELU DUZEGO OSADNIKA NA UJECIU WODOCIAGOWYM), W. Petrozolin.

Gaz, Woda i Technika Sanitarna, Vol 48, No 7, p 232-235, 1974.

Descriptors: \*Hydraulic models, Flow rates, Efficiencies, Wind, Model studies, \*Waste water treatment, \*Sewerage.

Identifiers: \*Warsaw(Poland), Settlers, Water capture.

Studies were conducted on a hydraulic model of a large capacity settler in the Warsaw sewage system in order to investigate the feasibility of improvements in the old settler built between 1924 and 1928. The scale was 1:25, the length of the model 32 m, the width 13 m, and the depth 12 to 16 cm. The model was installed in conditions similar to actual settlers. The studies were conducted in August, September, and October 1971; June 1972; and November 1972. The parameters studied were: the surface of the water in the settler, the intensity of the flow, division of flow through three openings, the wind, and the existence or absence of partitions impeding or changing flow direction. Wind was the major significant factor. Conclusions were reached by comparing mean velocities in selected partitions of the model with mean theoretical velocities. At maximum velocities from 1.42 m/min to 0.19 m/min, the mean velocities varied from 0.59 to 0.12 m/min, the mean active depths constituted a 23% to 77% of the total depth, and the mean active velocity was 1.3 to 4.9 times higher than the mean theoretical velocity. The flow time varied from 2 to over 9 hours during various days or times of the day, influencing the maximum velocity and settling of the wastes. The disturbing action of the wind regulated the settler's activity, but efficiency could be increased by only four percent. (Urbanski-FIRL) W75-10043

#### ELEVATED TEMPERATURE TECHNIQUE FOR ENUMERATION OF SALMONELLA IN SEWAGE,

Central Public Health Engineering Research Inst., Nagpur (India). Div. of Microbiology.

P. M. Phirke. Indian Journal of Medical Research, Vol 62, No 6, p 938-944, June 1974. 4 tab, 12 ref.

Descriptors: \*Salmonella, \*Pathogenic bacteria, \*Sewage treatment, \*Analytical techniques, \*Pollutant identification, Bacteria, Cultures, Sewage bacteria, Water quality control, Sewage, Isolation, Waste water treatment.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

**Identifiers:** Most probable number.

A quantitative method for determining *Salmonella* in sewage is described. The technique uses the most probable number method and incubation of the samples at an elevated temperature of 41.5°C in a selenite brilliant green enrichment broth. The broth is composed of mannitol, sodium taurocholate, sodium selenite, peptone, yeast extract, dipotassium phosphate, brilliant green, and distilled water. A sample of sewage was thoroughly homogenized by shaking and was subdivided into seven portions. Each portion was treated as a separate sample and inoculated in duplicate sets. One set was incubated at 41.5°C and the other set was incubated at 37°C. The data indicate that enrichment at 37°C yields too low numbers. The results from the 41.5°C technique are better, more consistent and reliable than the results from the 37°C temperature. The difference in *Salmonella* recovery may be due to the fact that at 37°C most of the interfering organisms grow faster and mask the growth of the *Salmonella*. However, at 41.5°C, *Salmonella* growth is enhanced and the growth of the interfering organisms is inhibited. This method for the determination and enumeration of *Salmonella* will be of value in assessing the effectiveness of sewage treatment plants in the removal of *Salmonella* bacteria. (Orr-FIRL)  
W75-10045

**AN AUTOMATED METHOD FOR DETERMINATION OF RESIDUAL METHANOL IN DENITRIFIED EFFLUENTS,**  
Water Pollution Research Lab., Stevenage (England).  
C. C. Musselwhite.  
Water Pollution Control, Vol 74, No 1, p 110-111, 1975. 1 fig, 2 tab, 2 ref.

**Descriptors:** \*Automation, \*Waste water treatment, \*Denitrification, Monitoring, Sewage treatment, Oxidation, Pilot plants, Costs, Effluents, Rivers, Analytical techniques, \*Pollutant identification.  
**Identifiers:** \*Methanol, Technicon Auto Analyzer, Residual method.

An automated method has been developed to determine the amount of residual methanol in denitrified effluents. Biological denitrification is used to reduce the oxidized nitrogen content of effluents which are discharged to rivers. Methanol is currently used as a carbon source when nitrified effluents are deficient in biodegradable organic carbon. Pilot plant studies have been conducted using methanol for denitrification. For economical and efficient use of methanol, its concentration should be monitored in denitrified effluents. A Technicon Auto Analyzer and procedures for its use are described. The method is based on the oxidation of methanol to formaldehyde, determined colorimetrically after reaction with acetylacetone. The method was suitable for monitoring residual methanol either in discrete samples or continuously in denitrified effluents. Correction for interference in the measurements of peaks may be necessary in some instances, and the method is applicable to a wide range of sewage samples. (Prague-FIRL)  
W75-10047

**THE SOURCES AND LEVELS OF MERCURY IN THE SEWAGE OF A UNIVERSITY CAMPUS,**  
Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.  
For primary bibliographic entry see Field 5A.  
W75-10049

**EXPERIMENTAL EUTROPHICATION OF TERRESTRIAL AND AQUATIC ECOSYSTEMS. FIRST ANNUAL REPORT OF THE UPLAND RECHARGE PROJECT,**  
Brookhaven National Lab., Upton, N.Y.

**G. M. Woodwell, J. Ballard, M. Small, E. V. Pecan, and J. Clinton.**  
Report BNL 50420 (Biology and Medicine TID-4500), February 1974. 29 p, 17 fig, 11 tab, 12 ref. AEC AT(30-1)-16.

**Descriptors:** \*Model studies, \*Waste water treatment, \*Tertiary treatment, \*Aquatic habitats, \*Terrestrial habitats, Groundwater recharge, Nutrient removal, Vegetation, Forests, Agriculture, Waste water disposal, Recycling, Sewage treatment, Nutrients, New York.  
**Identifiers:** Brookhaven(NY).

Alternatives to dumping sewage into coastal oceans are being studied at the Brookhaven National Laboratory, New York. A report on the development of a system of sewage treatment that returns potable water to the water table and recycles the nutrients with the least input of fossil fuel energy is presented. The quality of groundwater varied; the highest quality was associated with undisturbed forest. The greatest variation was in nitrogen and calcium which were high in agricultural fields, low in oil fields and pine forests, and lowest in late successional oak-pine forests. After six months application of sewage, phosphorus and iron were totally absorbed, sulfur and magnesium partially absorbed, potassium and calcium increasingly absorbed, and sodium and chlorine not absorbed. Nitrate nitrogen in the percolate of oak-pine forests treated with primary effluent rose slowly during September and October, and more rapidly in November and December. In the forest treated with secondary effluent, the nitrate-nitrogen level reached a maximum in November. In aquatic systems, meadows effectively reduced the organic content and reduced the specific conductance of sewage during the winter. A combination of aquatic and terrestrial systems will probably be the most effective treatment method. (Buchanan-Davidson-Wisconsin)  
W75-10097

**AN INTEGRATED SYSTEM FOR DISPOSAL OF SLUDGES ORIGINATING FROM WATER SOFTENING AND SEWAGE TREATMENT IN MUNICIPALITIES,**  
Kansas Univ., Lawrence. Dept. of Civil Engineering.

J. W. Moore.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 879, \$8.50 in paper copy, \$2.25 in microfiche. Ph.D. Thesis, 1971. 244 p, 43 fig, 38 tab, 54 ref. OWRT A-031-KAN(3). 14-31-0001-3016.

**Descriptors:** \*Waste water treatment, \*Sludge treatment, \*Water softening, \*Sludge disposal, Economics, Recirculated water, Kansas, Phosphorus, Hydrogen ion concentration, Chemical oxygen demand, Alkalinity, Sewage treatment, \*Solid contact processes.

The objective was to explore the feasibility, both technically and economically, of developing an integrated system for the disposal of sludges originating from water softening and sewage treatment in municipalities. The proposed system consists of utilizing the water softening sludge in a beneficial use in the primary treatment process of the sewage treatment plant, then handling the resulting sludge in one disposal operation. A laboratory solids contact unit was constructed and operated on raw wastewater with lime softening sludge added at the rate of 600 milligrams per liter of raw sewage. Provisions were included for the recirculation of the lime softening sludge. The effluent from the solids contact unit was characterized and dewaterability studies were performed on the sludge retained in the unit. Both orthophosphate and total phosphorus concentrations normally present in domestic sewage can be reduced by about 20 per cent for orthophosphate and 30 per cent for total phosphorus by the addition of 600 milligrams of lime softening sludge per liter of raw sewage with continuous mixing. The

total phosphorus removal can be increased to about 46 per cent by recirculation of the lime softening sludge. The addition of lime softening sludge with recirculation resulted generally in a pH of 7.8, chemical oxygen demand removal of 65 percent, five-day biochemical oxygen demand removal of 75 per cent and total solids removal of 35 per cent. A pH increase of about 0.4 pH unit and an alkalinity increase of about 50 milligrams per liter were observed. The sludge withdrawn from the primary unit can be expected to be about 3.5 times that resulting from conventional settling but when the total sludge quantities are compared for the overall system, including waste activated sludge and lime softening sludge, the lime softening sludge system results in a total sludge production only slightly larger than in separate systems. The mixture of lime softening sludge and primary sludge filtered well without filtration aids.  
W75-10123

**A COMPUTER SIMULATION ANALYSIS OF SURFACE WATER QUALITY MANAGEMENT POLICIES UNDER DYNAMIC ECONOMIC AND HYDROLOGIC CONDITIONS,**  
Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.

J. W. Hyden.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 842, \$9.25 in paper copy, \$2.25 in microfiche. Ph.D. Dissertation, August 1973. 294 p, 16 fig, 9 tab, 69 ref, 14 append. OWRT B-030-SC(5).

**Descriptors:** \*Water quality standards, \*Economics, \*Management, Surface waters, \*Simulation analysis, Computer models, Water policy, \*Waste water treatment, \*Optimization, Model studies, \*Computer programs.

The general purpose of this research is to determine the optimal economic wastewater treatment levels for individual users in a river basin. The specific case used in this study consists of a series of firms located along a river, such as municipalities, wet process industries, or recreational facilities, which have the river as their only source of raw water supply, and as the ultimate discharge point of their wastewater. The economically optimal wastewater treatment assignment levels are defined as the minimization of the sum of costs imposed on the individual users for wastewater treatment and of those resulting from damages caused by waste discharges of the upstream users. It is shown mathematically that the optimum occurs when, for all users, the marginal treatment cost equals the sum of the respective downstream marginal damage costs. Analyses of the effectiveness of a given water quality management policy in maintaining reasonable economic efficiency as various conditions change are presented in a prototype, computer simulation program, in order to consider such an approach in river basin planning activities.  
W75-10124

**USE OF LIME-SODA ASH SOFTENING SLUDGE FOR THE TREATMENT OF MUNICIPAL WASTEWATER,**  
Kansas Univ., Lawrence. Dept. of Civil Engineering.

W. E. Johnson.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 913, \$2.25 in microfiche. M.S. Thesis, (1971). 47 p, 6 fig, 14 tab, 17 ref. OWRT Project A-031-KAN(2). 14-31-0001-3016.

**Descriptors:** \*Kansas, Waste water treatment, \*Sludge treatment, \*Water softening, \*Sludge disposal, Sedimentation, Recirculated water, Phosphorus, Hydrogen ion concentration, Lime, \*Municipal wastes, Waste disposal.  
**Identifiers:** Jar tests, \*Lime-soda ash process, Lawrence(Kan).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

Research was conducted on the characterization of the sludge produced by a lime-soda ash water softening process and the possible utilization of the lime sludge for precipitation of phosphorus and other pollutants from Lawrence wastewater. The lime sludge consisted of calcium carbonate (85%), magnesium hydroxide (4%), and volatile suspended solids (6%); 2.6 pounds of lime sludge was produced per pound of lime added to the water being treated in the softening process. About 400 to 600 mg of lime sludge per liter of wastewater could be added. This amount of lime sludge raises the pH about 0.5 of a pH unit which is not near the anticipated pH of 9.5. At a pH of 9.5 there is good phosphorus removal and additional BOD and COD removal. Jar tests with lime sludge and additional lime to raise the pH to 9.5 showed that lime sludge tends to resist a change in pH. Phosphorus removal from wastewater would not be significant on a continuous run basis with the amount of sludge produced by the Lawrence water treatment plant.

W75-10125

#### LABORATORY SIMULATION OF SWINE MANURE LAGOONS,

Clemson Univ., S.C. Dept. of Agricultural Engineering.

C. L. Barth.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 888, \$3.25 in paper copy, \$2.25 in microfiche. Presented at 70th Annual Meeting of the Association of Southern Agricultural Workers, Incorporated, February, 1973, Atlanta, Georgia. 9 p. 6 fig, 5 tab, 11 ref. OWRT A-025-SC(1).

Descriptors: \*Farm lagoons, \*Physical properties, \*Chemical properties, \*Anaerobic digestion, Lagoons, Temperature, Biodegradation, Southeast U.S., \*Design criteria, Load distribution, Hogs, \*Waste treatment. Identifiers: Detention time, Volatile-solids-reduction, \*Laboratory simulation, Load rates.

Anaerobic lagooning of swine manure waste is widely used and is considered successful in the Southern Region of the United States. Evaluation of the variation in design standards employed by individual states in the region indicates that much uncertainty exists in the application of present knowledge and design values. A progress report is presented on a study of anaerobic lagooning properties of swine waste. Findings indicate the effect of loading rate and temperature in lagoon operation. This research provides basic knowledge on lagoon operation under conditions prevalent in the Southern Region and contributes to more uniformly applied design criteria.

W75-10137

#### BIOLOGICAL WASTEWATER TREATMENT MODEL BUILDING FITS AND MISFITS,

Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.

W. C. Boyle, and P. M. Berthouex.

Biotechnology and Bioengineering, Vol 16, No 9, 1139-1150, 1974. 6 fig, 3 tab, 43 ref.

Descriptors: \*Biological treatment, \*Waste water treatment, Statistics, \*Model studies, Data collections, Treatment facilities, Design criteria, Operations, \*Statistical models.

Identifiers: Model parameter estimation, Model discrimination.

During the past decade, statisticians have attempted to develop a uniform biological waste water treatment model which would aid in the design and operation of treatment facilities. A discussion of the validity of a single model is presented, including statistical problems in model parameter estimation and model discrimination. The physical process of fitting models usually precedes model building but parameter estimation processes are often overemphasized. Examples

were given to illustrate that a model cannot be accepted simply because it fits the data. Goodness of fit is a necessary but not sufficient condition for acceptance of any model. When two or more conflicting models fit the data, it is necessary to give each model a chance to fail in order to verify a proposed model. (Prague-FIRL)

W75-10169

#### MODELING MICROBIAL GROWTH IN WASTEWATER TREATMENT,

Royal Inst. of Tech., Stockholm (Sweden). Dept. of Water Chemistry.

B. Hultman.

Journal Water Pollution Control Federation, Vol 47, No 4, p 843-850, April, 1975. 4 fig, 4 tab, 10 ref.

Descriptors: \*Bacteria, \*Biological Treatment, \*Model studies, \*Waste water treatment, Equations, Activated sludge, \*Microbial degradation, Growth rates.

Identifiers: \*Bacterial growth.

A model for bacterial growth was developed in order to choose suitable reactors for biological treatment of waste water. The growth equations for bacteria were divided into formation rate of living bacteria; formation rate of nonviable bacteria; utilization rate of substances necessary for cell synthesis; utilization rate of the energy source; utilization rate of the electron acceptor; and formation rate of a product. Bacteria may grow in suspensions, such as in the activated sludge process or anaerobic digesters, on inert contacting material such as trickling filters, rotating disks, contact aerators, or inert suspended solids, and on adsorbing materials such as activated carbon. Rate constants were determined using stoichiometric and thermodynamic theories. The most common method for the biological treatment of waste waters in Sweden, is the activated sludge process, where bacteria grow in suspension. However, in some process combinations including postprecipitation or biological nitrogen reduction, bacterial growth on inert or adsorbing contact materials may be superior to that in suspended growth reactors. (Prague-FIRL)

W75-10170

#### NEEDED: \$350 BILLION - AND A NEW NEEDS SURVEY,

A. S. Heid.

Journal Water Pollution Control Federation, Vol 46, No 10, p 2254-2257, October 1974. 1 tab.

Descriptors: \*Federal Water Pollution Control Act, \*Water pollution control, \*Pollution abatement, \*Costs, \*Construction, Facilities, Storm water, \*Sewage treatment, Tertiary treatment, Sewers, Governments, Legislation, Governments supports, Financing, \*Waste water treatment, Surveys.

State agencies have now estimated that to meet the 1983 goals of the Federal Water Pollution Control Act Amendments of 1972, they would require \$350 billion. Money needed for treatment and control of storm water, a category not previously included, totals \$235 billion. Omitting this category, the states' estimated needs for 1974 are \$55 billion more than the \$60 billion reported in the 1973 survey. The 1974 survey was ordered by Congress to provide information on states' estimated needs to form a basis for the consideration of a new authorization for granting construction funds and for future allocations to the states. The cost estimates of the 1973 survey represented only a first step in the necessary assessment of construction costs. However, as reported by R. Train, EPA administrator, the EPA preliminary analysis exaggerates the costs of meeting the requirements of PL 92-500; there are less expensive methods of abating storm water pollution than those figured in the costs. In addition, the EPA considers following categories the important areas for granting construction funds: Category I-costs necessary to

achieve the required level of secondary treatment; Category II-costs necessary to achieve more stringent levels of treatment than secondary treatment for cases in which advanced treatment is implicit for meeting established standards for water quality; and, Category IVB-costs for new interceptor sewers. (Orr-FIRL)

W75-10174

#### LET'S TRY 90% FIRST AND SEE WHAT OUR QUALITY IS LIKE,

Wesleyan Univ., Middletown, Conn. Industrial Waste Lab.

For primary bibliographic entry see Field 5G.

W75-10175

#### LACK OF PROMISED FEDERAL FUNDS HAM-PERS WATER CLEANUP EFFORT.

For primary bibliographic entry see Field 5G.

W75-10178

#### DESIGN OF SURFACE WATER OUTFALLS TO RIVERS,

Lothians River Purification Board (Scotland).

G. S. Hamilton, and G. A. Haig. Surveyor, Vol 145, No 48-49, February 7, 1975. 1 fig.

Descriptors: Surface waters, Rivers, Discharge(Water), \*Design criteria, Drainage engineering, Hydrological aspects, Flood control, Outlets, \*Outfall sewers, \*Outlet works, \*Sewers.

A design for a simple outfall arrangement from surface water drainage systems to a river is illustrated. The Lothians River Purification Board, Great Britain, has adopted engineering guidelines for discharging to rivers. Principles to be followed include protection of the river bed from scour, compatibility with the hydrological characteristics of the river, protection of the banks of the river, and access availability for inspection and maintenance. Once the outfall velocity has been selected, the energy of the water is dissipated and scour is resisted by the construction of energy dissipators in the form of steps, by angular outflow to the river (generally 60 degrees to the river flow), and by protection of the river bed by a gabion mattress. For all outfall design calculations, the engineer must consider the hydrological regime of a specific river to determine flood frequency curve in terms of river stage at the outfall point, so as to protect the surface water system in flood conditions. The banks of rivers are protected by wing walls with stable bank protection behind the walls; access to the outfall should be provided in the form of steps for sampling and maintenance purposes. (Prague-FIRL)

W75-10183

#### THE MAGNETIC FLOWMETER AND ITS USE IN WASTE WATER TECHNOLOGY (DER MAGNETISCHE DURCHFLUSSMESSER UND SEINE ANWENDUNG IN DER ABWASSER-TECHNIK),

For primary bibliographic entry see Field 5A.

W75-10185

#### ENERGY EVALUATION AND ORGANIC COMPOUND INDEX IN MUNICIPAL SEWAGE WATER (IN JAPANESE),

T. Aida, I. Munemiya, and K. Kawamura.

Gesido Kyokai-shi, Vol 11, No 127, p 21-31, December 1974. 8 fig, 22 ref.

Descriptors: \*Municipal wastes, \*Sewage treatment, Sampling, Biochemical oxygen demand, \*Organic compounds, Oxidation, \*Waste water treatment, \*Pollutant identification, \*Organic wastes.

Identifiers: Enthalpy change, Organic compound index, Thermodynamics.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

An equation to calculate an approximate BOD value was obtained from a thermodynamic consideration based on the enthalpy change in oxidation reactions of organic compounds. BOD was equal to 0.146 times the enthalpy change of organic compounds. The applicability of the equation to actual sewage water samples was evaluated by determining BOD values of samples collected at two different cities by the sodium oxide method. The calculated BOD values agreed with the observed values for untreated sewage water; however, they did not agree for treated sewage water. This indicates that highly undecomposable oxidation products contributed to the observed BOD values. Therefore a constant term must be added to the equation, depending on the sewage plants. A similar thermodynamic consideration was made for TOD calculation; its correlation with BOD was 0.502. For the same sewage water samples, the COD and TOC values were also analyzed and the average correlation factors of BOD to COD and TOC were 0.5 and 1.3 respectively. (Katayama-FIRL)

W75-10189

#### NEW FLOWMETER PASSES TESTS,

General Signal Corp., West Warwick, R.I.  
J. R. Daneker, and J. S. Kontor.  
Water and Wastes Engineering, Vol 12, No 4, p 58, 60, April 1975.

Descriptors: \*Analytical techniques, \*Instrumentation, \*Flow measurement, Liquids, Maintenance, Equipment, Municipal water, Sewage treatment, Treatment facilities, \*Waste water treatment, Pollutant identification.

Identifiers: \*Solids-bearing fluids, \*Flowmeters.

A flowmeter for measuring solids-bearing fluids (SBF) has been tested for two and one-half years in waste water treatment plants in thirteen United States cities. Conditions varied regarding metering application, line pressure, line size, and systems function. In all cases, the SBF was an extremely accurate device. Most municipalities experienced some problems with material build-up on the inside wall of their sludge lines; techniques to alleviate this problem are described. For example, the City of East Providence, Rhode Island recirculates flushing water, the East Bay Municipal Utility District in Oakland, California utilizes 140 F (warm) water for flushing, and Orange County, California uses extensive steaming at 250 F for four hours to keep the lines clean. Periodic maintenance for sewage treatment systems has also been minimized by using glass linings which are less susceptible to material buildup. The major advantage of the SBF system over previous fluids measuring devices is that field checking is easily accomplished. The primary instrument can be positively field checked using a manometer. The pressure sensors can be checked by visible means, comparing differential pressure output of the sensors against that of a manometer directly on the venturi. When the two differential pressures agree, the performance of the associated instrumentation is easily checked. (Prague-FIRL)

W75-10190

#### ENGINEERING UTILITY AND SEWAGE LINES IN PERMAFROST SOIL,

A. L. Yastrebov.

Available from the National Technical Information Service, Springfield, Va. 22161, as AD-786 964, \$8.50 in paper copy, \$2.25 in microfiche. May, 1974. 258 p, 69 fig, 19 tab, 6 append. Translated from *Inzheinerlyye Kommunikatsii na Vechnomerzlykh Gruntakh, Lit. po Stroitel'stvu Press, Leningrad, 176 p, 1972.*

Descriptors: \*Sewers, \*Sewerage, \*Pipelines, \*Construction, \*Design, Permafrost, Soil mechanics, Soil properties.

Identifiers: Petroleum pipelines, Gas lines.

Various methods are presented of laying and designing pipelines for water supply, heat supply, and sewerage, in addition to trunk petroleum and gas lines in permafrost conditions. General information is presented on engineering utility and sewage lines in permafrost soil. The construction of sanitary engineering utility and sewage lines and trunk pipelines, is described. A collection of initial data is presented for calculating structures. Thermal calculations such as heat losses of pipelines, underground conduits, temperature of liquids in pipelines, and amount of insulation are discussed. The calculation of supports and foundations of engineering utility and sewage lines is outlined. Procedures for the thermal calculation of pipelines and for supports and footings of engineering utility and sewage lines in various permafrost soil conditions are set forth. The calculation theory is illustrated with examples from current design practice. (Orr-FIRL)

W75-10192

#### LARGEST ADVANCED WASTEWATER TREATMENT PLANT IN THE U.S. AND IN THE WORLD,

Stearns and Wheler, Cazenovia, N.Y.  
D. E. Schwinn, and G. K. Tozer.  
Environmental Science and Technology, Vol 8, No 10, p 892-897, October, 1974. 5 fig, 1 tab.

Descriptors: \*Treatment facilities, \*Waste water treatment, \*District of Columbia, Design criteria, Control, Computers, \*Tertiary treatment, Planning, Pilot plants.

Identifiers: Blue Plains Water Pollution Control Facility.

The District of Columbia's Blue Plains Water Pollution Control Facility has been studied since 1968. Key process steps to improve the plant have been underway since 1971. Design steps have been implemented concurrently with confirmatory tests at the EPA-DC Pilot Plant on D.C. waste water. Methods which were analyzed included: nitrogen removal by the biological nitrification-denitrification process, consisting of nitrification and denitrification reactors and sedimentation basins; phosphorus removal by the addition of alum and/or ferric chloride to both the secondary modified aeration system and the denitrification system; sludge processing by gravity thickening of primary and storm water sludges; and flotation thickening of secondary and advanced treatment sludges, followed by vacuum filtration and incineration. The advanced waste water treatment facilities were designed for operation in two halves to permit comparative tests while operating at different MLSS concentrations, chemical dosages, and other variables. When the treatment plant is completed, it will contain four computer systems, three for process control and one for data processing. The processes to be controlled by these systems are return sludge, waste sludge, chemical treatment (lime, ferric chloride or alum, methanol, and polymer), and pumping. Using the D.C. concurrent design and pilot plant testing has saved two years of time, and the plant to be built will be the largest of its type. (Prague-FIRL)

W75-10193

#### OPERATION OF FULL-SCALE BIOLOGICAL PHOSPHORUS REMOVAL PLANT,

Biospherics, Inc., Rockville, Md.  
G. V. Levin, G. J. Topol, and A. G. Tarnay.  
Journal Water Pollution Control Federation, Vol 47, No 3, p 577-590, March, 1975. 5 fig, 10 tab, 12 ref.

Descriptors: \*Nutrient removal, \*Phosphorus, Biological treatment, Treatment facilities, \*New York, Monitoring, Activated sludge, Microorganisms, Precipitation(Chemical), \*Waste water treatment, Aeration, Operating costs.

Identifiers: \*Phosphorus removal, \*Phostrip, Seneca Falls(NY).

The first full-scale installation of the Phostrip process of phosphorus removal from waste water, marketed by Union Carbide, is in operation at Seneca Falls, New York. The first thirty days of operation were closely monitored, then this biological process was installed on a permanent basis. The method is based on the use of activated sludge microorganisms to transfer phosphorus from inflowing waste water to a small concentration substream for precipitation. The activated sludge is subjected to anaerobiosis, inducing phosphorus release into the substream and providing phosphorus uptake capacity when the sludge is returned to the aeration basin. Total phosphorus effluents as low as 0.2 mg/liter were obtained in full scale plant operation, a level far below the New York State effluent limit of 1.0 mg/liter. Total costs of phosphorus removal, particularly operating costs, were drastically reduced, as compared to conventional methods. (Prague-FIRL)

W75-10194

#### DISPOSAL OF WASTE ALUM SLUDGE FROM WATER TREATMENT PLANTS,

Malcolm Pirnie, Inc., Paramus, N.J.

R. M. Gruninger.

Journal Water Pollution Control Federation, Vol 47, No 3, p 543-552, March, 1975. 3 fig, 5 tab, 4 ref.

Descriptors: \*Alum, \*Water treatment, \*Waste water treatment, \*New York, Dewatering, Waste disposal, Land management, Filtration, Separation techniques.

Identifiers: Gravity thickening, Landfill disposal.

The Environmental Protection Agency has classified alum sludge from water treatment plants as an industrial waste which may no longer be discharged to streams. Treatment plants in western New York State have been constructed and are operating plant scale alum sludge treatment units; four such alum sludge dewatering facilities are discussed. Characteristics of the sludges were affected by the substances used in water treatment and may be highly variable. No single system can economically dewater dilute alum sludge to the minimum acceptable concentration for landfill disposal. An investigation of alternatives indicated that the separation of the solids from alum sludge is best accomplished in a two stage system. The first step should be primary thickening by gravity to achieve a solids concentration of two to six percent total solids by weight. The second stage is mechanical dewatering, achieved through pressure filters, vacuum filters, or scroll centrifuges, obtaining a solids concentration of at least 20 percent total solids by weight. (Prague-FIRL)

W75-10195

#### REMOVAL OF ORGANIC MATTER BY ACTIVATED CARBON COLUMNS,

Illinois Univ., Urbana Dept. of Civil Engineering, F. B. DeWalle, and E. S. K. Chian.  
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EES, p 1089-1104, October, 1974. 6 fig, 2 tab, 32 ref.

Descriptors: Activated carbon, \*Activated sludge, Effluents, Sewage treatment, \*Organic matter, Adsorption, \*Waste water treatment, Tertiary treatment.

Identifiers: Molecular weight, \*Activated carbon columns, TOC.

Activated carbon treatment is conventionally used as a tertiary unit process following activated sludge treatment. However, it has been suggested that there is significant leakage of organic matter through the columns and that activated sludge treatment adversely affects the removal of organic matter in activated carbon columns. An evaluation of the effect of activated sludge treatment on the composition of organics in the effluent and this effect on subsequent activated carbon treatment was conducted. The composition of the organic matter

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

in secondary effluent was studied as was the removal of these compounds in activated carbon columns. The major organic fraction adsorbed in activated carbon columns is a fulvic acid-like material with a molecular weight of 100 to 10,000. These compounds adsorb very well in activated carbon columns. Since they also represent a major fraction of the organic matter, adsorption in activated carbon columns was expected to increase with increasing degradation of the waste water. This phenomenon did occur in a study in which the TOC removal of a filtered mixed liquor by activated carbon increased in the succeeding compartments of a plug-flow activated sludge unit. (Prague-FIRL)  
W75-10197

#### SECONDARY TREATMENT DESIGN FOR COMBINED WASTEWATERS, PART II, C. N. Smith.

Water and Sewage Works, Vol 122, No 4, p 82-84, April, 1975. 1 fig.

Descriptors: \*Sewage treatment, \*Design, \*Waste water treatment, \*Industrial wastes, Municipal wastes, Canneries, Tannery wastes, Aeration, Chlorination, Dewatering, Sludge, Effluents, Water pollution control, Treatment facilities, Filtration, Disinfection, Maine.

Identifiers: South Paris(Maine), Clarification, Carbonation, Chromium removal, Sulfide removal, Pretreatment(Waste water).

A unique Water Pollution Control Facility is being constructed at South Paris, Maine, for the joint treatment of wastes from the town, a cannery and a tannery. The project is scheduled for completion in the spring, 1975; the total cost is \$6,800,000 of which \$4,500,000 is the facility construction cost. A detailed outline of the treatment scheme is presented. The system includes: pretreatment of the combined cannery and municipal effluents; pretreatment of the beam house wastes and tan house wastes; primary clarification; aeration; carbonation; secondary clarification; and chlorination. The tannery effluents are treated by filtering through rotating drum screens, equalization, clarification, carbonation, and upflow clarification before being mixed with the pretreated municipal and cannery sludge in the aeration tanks. Two systems of sludge dewatering are provided, one for the sludge from the carbonation clarifier and one for the sludge from the secondary clarifier. The treatment will provide for 90 percent chromium removal, 100 percent sulfide removal, and 99 percent disinfection. (Orr-FIRL)  
W75-10199

#### CLEANING OF PETROLEUM-INDUSTRY EFFLUENT,

V. P. Tronov, R. G. Nurutdinov, and A. D. Li. Soviet Patent SU432106. Issued June 23, 1971. Soviet Inventions Illustrated, Vol W, No 17, p 2, June, 1975.

Descriptors: \*Waste water treatment, \*Industrial wastes, Oil industry, \*Effluents, Emulsions, \*Patents, Cleaning, \*Oil pollution, Oil wastes. Identifiers: Drainage tanks, Buffer tank.

A treatment method for a petroleum processing waste water stream is described. The petroleum is diluted by a stratum flooding system in an amount corresponding to a ratio of 0.4 between the total water flow and the emulsion flow. The water leaving the plant (98-99 percent) is sent into a feedstock line about one km from a preliminary tank. The retention time in the feedstock line is 15-21 minutes. An emulsion containing 10-12 percent water passes from the preliminary drainage tank to the next stage. The settled water from the preliminary drainage tank is sent to a buffer tank where it is kept for 1.5-2.0 hours before being pumped into the stratum flooding system for use as dilution water. If the starting emulsion contains less than 30 percent water, then the required phase ratio can

be maintained by preliminary accumulation or addition from another source. (Orr-FIRL)  
W75-10200

#### MEAN ESTIMATE DEFICIENCIES IN WATER QUALITY STUDIES,

McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.

For primary bibliographic entry see Field 5G.

W75-10202

#### OPTIMAL CONTROL OF WATER POLLUTION IN A RIVER STREAM,

Alberta Univ., Edmonton. Dept. of Electrical Engineering.

For primary bibliographic entry see Field 5G.

W75-10206

#### EFFECTS OF DEPOSIT RESUSPENSION ON SETTLING BASIN,

Kyoto Univ. (Japan). Dept. of Chemical Engineering.

For primary bibliographic entry see Field 5F.

W75-10213

#### DYNAMIC LEACHING STUDIES ON PULP-WOOD BARK RESIDUES,

British Columbia Univ., Vancouver. Dept. of Civil Engineering.

A. H. Benedict, J. J. McKeown, and R. D. Hart.

Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EE4, Paper No 10701, p 869-882, August 1974. 15 fig, 3 tab, 1 equ, 1 ref.

Descriptors: \*Water pollution control, Pulp and paper industry, \*Leaching, \*Sewage treatment, \*Solid wastes, \*Bark, Disposal, Operations, Effects, Biochemical oxygen demand, Industrial wastes, Water quality, Chemical oxygen demand, \*Pulp wastes, \*Waste water treatment.

Identifiers: Receiving waters, BODS.

Recent years have witnessed a growing concern by the pulp industry over the effect of bark disposal operations on receiving water quality. In these circumstances, the National Council of the Paper Industry for Air and Stream Improvement, Inc., undertook a laboratory study to define the quantities of BOD<sub>5</sub>, COD, and color leached from fresh and field-aged pulpwood bark residues under several experimental conditions. Bark from northeastern species were used in all investigations. Results showed that the quantity of BOD<sub>5</sub>, COD, and color leached from bark residues under dynamic leaching conditions depends on the field-storage age of the bark and on the conditions under which leaching occurs. Working curves for estimating BOD<sub>5</sub>, COD, and color contributions from northeastern pulpwood bark residues are presented. (Bell-Cornell)  
W75-10214

#### AUSTRIAN PLANT KNOCKS OUT NITROGEN,

Technische Hochschule, Vienna (Austria). Institut fuer Wasserversorgung Abwasser Reinigung und Gewässerschutz.

N. F. Matsche, and G. Spatzierer.

Water and Wastes Engineering, Vol 12, No 1, p 18-24, January, 1975. 9 fig, 2 tab.

Descriptors: \*Treatment facilities, \*Aeration, Effluents, Sludge treatment, Construction costs, Sewage treatment, Design criteria, Nitrogen, \*Waste water treatment, Nitrification, \*Denitrification.

Identifiers: \*Vienna(Austria), \*Nitrogen removal.

The Vienna-Blumenthal treatment plant in Vienna, Austria uses aeration with mammoth rotors, alternately with oxic and anoxic zones in the cycling mixed liquor, to accomplish nitrification and denitrification. With experiments using differing

numbers of rotors, nitrogen removal level has reached up to 85%. The plant has a pumping station, screens, an aerated grit chamber, two aeration tanks, two final sedimentation tanks, and a return sludge pumping station. Waste water is lifted by screw pumps; coarse material is removed by bar screens; sand and floatable materials are removed in the grit chamber. Waste water flows directly to the aeration tanks. Mixed liquor is clarified in two final sedimentation tanks. Effluent flows directly to the receiving stream and the return sludge is pumped back with a constant flow to enter the aeration tank with the raw waste water. Excess sludge is removed from the return sludge by pumping it to the Liesingtal sewer to be treated at Vienna's main sewage treatment plant. Evaluations of construction costs, design data, and efficiency of the operation have been made since 1971. In 1974, different numbers of operating rotors were tested. Removal of excess sludge was held constant. Pollutant loading varies where industries discharge waste water into the system. Three plus three rotors is the normal optimal number for year round operation. NH<sub>4</sub>-N was determined in laboratory tests; organic nitrogen was estimated as well. (Prague-FIRL)  
W75-10225

#### NEW SEPARATOR MAY SPUR INTEREST IN SEDIMENTATION,

Glaus, Pyle, Schomer, Burns and DeHaven, Akron, Ohio.

R. Miller.

Water and Wastes Engineering, Vol 11, No 9, p 40-42, September, 1974. 2 fig.

Descriptors: \*Waste water treatment, \*Suspended solids, \*Separation techniques, Settling basins, Equipment, Desilting, Settling velocity, Sewage treatment, Water pollution control.

Identifiers: \*Lamella Separator.

It has been necessary in every type of water pollution control treatment to use some form of settling or filter system to remove solids from liquid wastes. A new concept for rapid settling of solids, employing basic gravity settling theories, is the Lamella Separator developed by the Axel Johnson Institute in Sweden. The Lamella is a gravity liquid solid separation unit which utilizes thin parallel plates packed as closely together as possible but still retaining a separation of settled solids from the clear liquid that is to be discharged as effluent. Depending on the application and local conditions, the plates are spaced from 35 to 50 mm apart on an incline of 25 to 50 degrees. The influent is distributed evenly over the plates as it enters in a vertical direction; it then moves downward with the solids which settle to the bottom of each plate. A return tube carries the effluent concurrently with the influent flow and back to the top of the unit where it is discharged. The settling solids drop into the sludge collector at the bottom of the unit. In theory, settling occurs on each plate provides a settling area equivalent to the projected horizontal area. External forces prevent the theoretical space saving of 20 times from resulting. The actual space saving is about 10 times. A pilot testing program using the Lamella settler parallel with primary settling to provide a comparison was conducted in Youngstown, Ohio. The unit performed well at a flow rate of 200 gpm; a conventional tank would require 10 times the total surface area to handle the same flow. At Youngstown, the system was compact, exhibited a high rate and was not seriously affected by load fluctuations. (Orr-FIRL)  
W75-10226

EVOLUTION OF MICROFLORA DURING PURIFICATION TREATMENT OF URBAN WATER BY ACTIVATED SLUDGE (EVOLUTION DE LA MICROFLORE AU COURS D'UN TRAITEMENT D'EPURATION D'EAUX URBAINES PAR BOUES ACTIVEES), Ecole Nationale Supérieure Agronomique de Grignon (France). Laboratoire de Recherches de la Chaire de Microbiologie.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

**J. Riviere.**

*Annales Agronomiques*, Vol 25, No 2-3, p 515-533, 1974. 9 tab, 46 ref. (English summary).

**Descriptors:** \*Bacteria, \*Biological treatment, \*Activated sludge, Measurement, Water pollution, *E. coli*, Nitrogen, Ammonia, \*Waste water treatment, Odors, Municipal water, Treatment facilities.

**Identifiers:** Bacterial pollution, Microflora.

Two stations of very different size and design were compared for their efficiency of bacterial pollution, during treatment of urban water by the activated sludge process. It appeared that: bacterial microflora were quite homogeneous in the ventilation tanks; and, compared to the inflow, a reduction of almost 90% the number of bacteria that can be revitalized is found in the outflow, for both *Escherichia coli* and fecal streptococci. However, neither station checked the sulphite reducing *Clostridium* spores. Very few nitrifying bacteria were found in either outflow. Ammonifying bacteria were checked by the station but aerobic nitrogen bacteria were not. Odor producing bacteria, which were very numerous in the inflow, were reduced by 80% in the outflow, including indologenous bacteria and hydrogen sulphide producing bacteria. The outflow contained considerable numbers of sulphate reducing bacteria, often a cause of chemical corrosion. Bacterial pollution checking-capacity of a large station was seen to be slightly less than that of an average size station. (Prague-FIRL)

W75-10227

**STUDIES CONCERNING DEWATERING OF DIGESTED COMMUNAL WASTE WATER SLUDGES ON SLUDGE DRYING BEDS (UNTERSUCHUNGEN ZUR ENTWAESSERUNG AUSGEFALTETER KOMMUNALER ABWASSERSCHLAEMME AUF SCHLAMMTROCKEN-PLATZEN),**

R. Boehm.

*Wasserwirtschaft-Wassertechnik*, Vol 24, No 8, p 280-284, 1974. 6 fig, 4 tab, 5 ref.

**Descriptors:** \*Sludge treatment, \*Dewatering, Automation, \*Waste water treatment, Activated sludge, Water purification, Sludge disposal.

**Identifiers:** Sludge drying beds.

Digested sludges from water purification formerly had to be dried in beds with a depth of 20 cm because they were then manually removed. For the use of automatic sludge removal equipment, higher layers are more suitable. For determination of the effect of the thicker layer on the drying process, experiments were carried out: in 4 by 8 m drying areas with concrete bases and drainage pipes; in 4 by 8 beds with cobble bases and drainage pipes; and in 4 by 8 m beds with gravel bases. Over a period of several years, the influence of the sludge layer (20, 30, or 40 cm), the type of base (concrete, cobble pavement, or gravel), and the origin of the sludge (mechanical or mechanical-biological waste water treatment) was studied under natural conditions. Sludges dried on the concrete base had a relatively pasty bottom layer while the top and center did not differ much from those in sludges dried on gravel bases. For automatic cleaning of sludge drying areas, a layer with a depth of 40 cm was found to be best. The drying process was impaired by the concrete base, particularly with sludges from activated sludge treatment stations. (Nave-FIRL)

W75-10228

**PILOT-PLANT INVESTIGATIONS INTO PARTIAL PRETREATMENT SYSTEMS AT MACCLESFIELD,**

F. E. Hambleton, and T. H. Kirby.

*Water Pollution Control*, Vol 73, No 5, p 521-531, 1974. 4 fig, 3 tab, 6 ref.

**Descriptors:** \*Waste water treatment, \*Biological treatment, \*Pre-treatment, Activated sludge, Filtration, \*Pilot plants, Sewage treatment, Costs, Construction materials, Filters.

**Identifiers:** High rate biological treatment, Macclesfield (Great Britain).

Continued growth of the population in the drainage area coupled with the expansion of a pharmaceutical factory led to demand for additional capacity at the treatment works at Macclesfield, Great Britain. A biological treatment plant had been installed between 1961 and 1964. Experimental work on biological filtration was carried out between 1966 and 1969. In 1970, a second program was tested to assess the effectiveness of partial pretreatment of settled sewage for the reduction of BOD before its discharge onto biological filters. Two partial pre-treatment systems were examined: a high-rate activated sludge system using surface aeration; and a high-rate biological filtration using plastics filter media, each with a pilot plant. Comparisons of costs and efficiencies are given. It was concluded that a pilot plant is far more difficult to operate effectively than a full sized sewage works. Additionally, while a high rate activated sludge unit requires only the existing filter beds to be retained for secondary biological filtration, a high rate filtration unit needs the addition of extensive supplementary low rate biological filters. (Prague-FIRL)

W75-10229

**LIQUID FILTER APPARATUS,**

*Hydromation Filter Co., Livonia, Mich. (assignee) G. Hirs.*

United States Patent 3,814,688. Issued June 4, 1974. Official Gazette of the United States Patent Office, Vol 923, No 1, p 264-265, June, 1974. 1 fig.

**Descriptors:** \*Patents, \*Water pollution treatment, Equipment, \*Filters, Filtration, \*Waste water treatment.

**Identifiers:** Liquid filter apparatus.

A liquid filtering device is described. The polluting liquid is introduced between opposed, planar, horizontal filter media. It then flows simultaneously through the opposed media to accrete the pollutants on the confronting faces of the media. The media are cleaned by interrupting the pollutant liquid flow and backwashing the upper filter media. Removable filter media can be discarded between the medial and lower chambers. This disposable filter is supported on a continuous conveyor and the medial and lower chambers may be separated to remove the disposable filter medium and the pollutants collected on both filter media. (Leibowitz-FIRL)

W75-10230

**A CONCEPT FOR MANAGING WASTE,**

*Gulf Waste Disposal Authority, Houston, Tex. J. P. Teller.*

*Chemtech*, p 222-224, April 1975. 3 fig.

**Descriptors:** \*Waste water treatment, \*Industrial wastes, Municipal wastes, Oil industry, Treatment, \*Cost allocation, Texas, Organic compounds, Organic wastes, \*Waste disposal, \*Oil pollution.

**Identifiers:** Petrochemical plants, Gulf Coast Waste Disposal Authority, \*Combined treatment.

The practical business aspects of a combined treatment system for wastes from several petroleum and petrochemical plants in the Houston, Texas, area are discussed. The Gulf Coast Waste Disposal Authority was organized in 1969 to dispose of industrial and municipal wastes. The Authority's first action was to convince five major companies, Champion International, Atlantic Richfield, Crown Central Petroleum, Petro-Tex Chemical, and Air Products and Chemical, to sign binding agreements to finance the 55 mgd Washburn Tunnel Facility. A treatability study was first

performed which determined that the wastes were amenable to combined treatment. The next phase was the establishment of the initial costs and percentage involvement of each company and signing of contracts. Some of the main points of the contracts include: an Industrial Advisory Council; the right of the companies to take over operation of the plant if the Authority is unable to continue operation; arbitration in case of contract administration disputes; and, a specified method for payment of (if any) levied fines. The advantages of the joint approach include the following: tax-free capital investment; ad-valorem tax exemptions; sales-tax free purchases by the Authority; chemical costs savings through the balancing effects of the various combined wastes; and elimination of multiple laboratory facilities. (Orr-FIRL)

W75-10236

**DESIGN FOR SOLVENT RECOVERY,**

*Chem-Pro Equipment Corp., Fairfield, N.J. J. W. Drew.*

*Chemical Engineering Progress*, Vol 71, No 2, p 92-99, February 1975. 11 fig, 6 tab, 4 ref.

**Descriptors:** \*Reviews, \*Costs, \*Design criteria, Water pollution control, Phenols, Solvents, Water reuse, Recycling.

**Identifiers:** \*Waste reuse, \*Solvent recovery.

A review is given of the necessary steps to establish a system of reusing solvents from exhaust air and waste water in terms of costs, shortages, and pollution problems. Recovery involves removal of the solvent or collection of a liquid solvent contaminated with chemicals, dirt, and other solvents. The collected solvent must be purified, usually by distillation, and sometimes additionally by extraction. Flowsheets illustrate alternative recovery processes. While direct distillation of solvents from waste waters is possible, it is often more economical to do preliminary extraction with a water-immiscible solvent and then separation from the solvent by distillation. Commercial applications of this method are the removal of traces of phenol from waste water and the recovery of acetic acid from dilute aqueous solutions. The economic specifications for recovered solvents are: water content of the solvent, 0.05-0.50%; cross mixing of solvents, 0.5-5.0%; and organic content of the waste water, 10 to 100 ppm. Design optimization for a test system has been computed. Costs for any application are correlated with size, material of construction, and increases due to inflation. Safety and experience factors should also be included among design criteria. (Prague-FIRL)

W75-10239

**WASTE-HEAT STEAM RUNS EVAPORATIVE WATER PURIFIER.**

*Chemical Engineering*, Vol 82, No 6, p 34, March 17, 1975. 1 fig.

**Descriptors:** \*Waste water treatment, Sewage, Industrial wastes, Oils, Chemicals, \*Water purification, Desalination, Evaporation.

**Identifiers:** \*Waste heat, Steam, Water purifiers.

An advanced method of waste water treatment has been developed by the Aluminum Company of America. Called the Alcoa Thermopure Process, this method uses waste heat and is related to previous environmental work in desalination. Low-pressure steam (5-10 psi) is generated by waste heat from various sources, such as furnace stacks. Wastes are concentrated by this process and can be recycled to recover chemicals and oils. Full-scale plant tests have used waste heat to treat effluent from a rolling mill. Earlier bench-scale and pilot plant tests showed that the process is effective for concentration of pollutants from sewage, suspended or emulsified oils, cooling towers, and chemical cleaning solutions. The basin unit operation employed is evaporation. Waste is pumped into the top of a vessel and dispersed by pres-

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surized air; the mixture of air and waste water is then heated by hot air and water vapor. Steam introduced into the lower part of the vessel supplies the heat. Humidified air separates the concentrated liquid wastes and is conducted up to bypass line to tube exteriors in the upper part of the vessel. Air cools while it heats incoming waste water-air mixtures. Vapor condenses simultaneously to deionized-quality water. The concentrated liquid is discharged to a tank where wastes can be mechanically separated; if recycling is to be used, mixed wastes are then recirculated. (Prague-FIRL)  
W75-10240

**EXTRACTION OF PETROLEUM HYDROCARBONS FROM OIL-CONTAMINATED SEDIMENTS,**  
Maryland Univ., College Park. Dept. of Microbiology.  
For primary bibliographic entry see Field 5G.  
W75-10241

**OZONE TECHNOLOGY GAINS SUPPORT.**  
Canadian Chemical Processing, Vol 59, No 1, p 19-22, January 1975. 2 fig.

Descriptors: \*Ozone, \*Canada, \*Water purification, \*Potable water, Industrial wastes, Pulp and paper industry, Oil wastes, Municipal water, Reviews, Chlorine, Odors.  
Identifiers: Montreal, Toronto, Quebec.

A state-of-the-art summary is given for current ozone uses and technology in Canada. Both Metro Toronto and Metro Montreal are installing large ozone plants for municipal water treatment. Montreal is building the world's largest ozone potable water treatment facility, while Toronto is installing ozone units for sewage treatment at two stations to eliminate odors. Most suppliers of ozonators to Canada are now from France and the United States; these corporations are discussed. Canadian industrial applications of ozone include its use in successfully removing phenol from petroleum refinery waste water and its use in treating kraft mill effluents in the paper industry. For such technology, the greatest expenditure is in ozonation equipment. Ozone generator outputs vary and costs are related to power consumption. Advantages of ozone both for industrial water treatment and for potable water are discussed. Chlorine is more prevalent in North America, while ozone is used widely in Europe. Specific water purification systems with ozone are cited in Long Island, New York, Indianstown, Florida, and Paris, France, and are compared with Canadian cities. (Prague-FIRL)  
W75-10242

**POLLUTION LAB PAYS OFF—TWO WAYS.**  
World Ports, Vol 37, No 4, p 20-21, March 1975.

Descriptors: \*Oil pollution, \*Industrial wastes, \*Combined wastes, \*Oil spills, \*Monitoring, Water pollution control, Oregon, Waste water treatment, Pollutant identification.  
Identifiers: Ballast wastes, Oil skimmers, Portland(Ore).

The operation of an oily ballast disposal plant at the Swan Island Ship Repair Yard, Portland, Oregon, is monitored so that waste water may be properly treated and then discharged to the municipal sewer system. Incoming material is checked for emulsification, to be sure that water is not chemically emulsified; for pH level, which must be corrected to be within the range 5.5 to 9.0; and for salt water content, which must be below 10,000 ppm. These criteria ensure that the ballast wastes will not kill the bacteria used in the sewage treatment system. Incoming waste water originates mainly from ships in drydock, where oil may have seeped into the bilge or where salt water may have been taken on as ballast while at sea. This water is treated in a separator where oil is

skimmed off and remaining water is then tested. Water of an acceptable quality is dumped into the sewer system. The oil is sold for use in road work and rerefinement. Protection against oil spills is provided by two oil skimmers at the shipyard. (Prague-FIRL)  
W75-10243

#### APPLICATIONS OF TOXICITY TESTING TO SEWAGE-TREATMENT PROCESSES, Trent River Authority (England).

M. B. Green, D. G. Willets, M. Bennett, R. F. Crowther, and J. Bourton.  
Water Pollution Control, Vol 74, No 1, p 40-58, 1975. 13 fig, 8 tab, 15 ref.

Descriptors: \*Biological treatment, \*Sewage treatment, Toxicity, Laboratory investigation, Invertebrates, Water quality control, Effluents, Aerobic treatment, \*Waste water treatment, \*Pollutant identification.

Identifiers: Enchytraeid worms, Screening, \*Toxicity tests.

Certain compounds present in industrial effluents are known to disrupt some of the biological stages of sewage treatment. Routine biological inspection of filters in the Upper Tame Main Drainage Authority area of Trent, Great Britain, indicated that filters at certain sewage treatment works had sparse populations of grazing invertebrates. The toxicity of sewage to macro invertebrates such as the enchytraeid worm *Lumbricillus rivalis* was tested. Applications of toxicity testing involve: measurement of compounds which are known to be deleterious to some extent and which are a usual feature of industrial effluent control, such as heavy metals in both aerobic and anaerobic treatment; industrial waste waters which are not readily controlled by limits determined by conventional analyses; and screening of newly-marketed formulations which might be present in sewage. Laboratory-scale activated sludge units and respirometric techniques were described. It was concluded that the application of toxicity testing to sewage treatment is a valuable method of re-assessing industrial effluent charges and of evaluating acceptable concentrations of certain wastes. Simple screening-test facilities are also useful to check and monitor problems concerning materials being discharged to a sewer. The techniques described are appropriate to the scale of sensitivity required for sewage treatment quality; for discharge of final effluent on watercourses, a higher level of sensitivity would be needed. (Prague-FIRL)  
W75-10244

#### COMPUTER CONTROL OF SEWAGE WORKS, PROGRESS AT NORWICH, C. E. Jones, and P. Cotton. Public Health Engineer, No 14, p 46-51, March 1975. 1 fig, 7 ref.

Descriptors: \*Computers, \*Waste water treatment, \*Sewage treatment, \*Automation, \*Pumps, Personnel, Monitoring, \*Digital computers, Treatment facilities.

Identifiers: Central Processor Unit.

The progress of a sewage treatment system using a Kent K.70 Central Processor Unit, including a Digital Equipment PDP8E mini computer is discussed. The computer, working at Norwich, Great Britain, has executive control over 60 operating sequences known as control loops as well as 30 subsequences to these loops. Operator control panels and a control setting panel provide communication with the computer. The programs were simulated and site tested, and personnel were given special training in computer technology. The operation in its initial stages has been evaluated and it was found that programming difficulties and faults are minor. An authoritative glossary of sewage treatment terms should be produced to aid communication between various aspects of the control projects. The computer has gone on line;

neither the C.P.U. nor the program have had major problems, and only five days were required to implement 30 percent of the programs. The computer can monitor the duration of storm overflows, operation of stand-by screen, operation of disintegrator pumps, starting and stopping low pressure effluent pump supplying screen, wash-water pump sumps, chemical storage tanks, and the operation of the standby detritor. Additionally, it can attend the main pumping for operating pumps, setting valves, selecting pump duty, and can keep accurate records. The system can automatically adjust certain items such as opening of control valves and speed of pumps more efficiently than by the manual system. Concern was expressed about number of hours of computer down time per 1000 hours; improvements have made the system more reliable. (Prague-FIRL)  
W75-10246

#### COMPUTERIZED SEWER DESIGN: NEW TOOL FOR AN OLD PROBLEM, Boyle Engineering, Santa Ana, Calif.

R. L. Ewing.  
Water and Sewage Works, Vol 122, No 4, p 67-69, April, 1975. 4 fig.

Descriptors: Computers, \*Sewers, \*Design criteria, Civil engineering, Costs, Hydraulic engineering, \*Arizona, Construction costs, Analytical techniques, \*Computer programs, Input-output analysis.

Identifiers: Plotted profile, Cost matrices, \*Sewer design, Phoenix(Ariz.).

Computer utilization in design of civil engineering systems has led to more systematic approaches to problems, including comprehensive analysis of design parameters, cost data, and system configurations. The applicability of computer programs was demonstrated in the study of a relief sewer route for the city of Phoenix, Arizona. Input to the computer included ground profile data, sewage flows from a master-plant study, types of manholes, and hydraulic design criteria. The output from the computer supplied engineering documentation such as: upstream and downstream manhole numbers; pipe length; pipe diameter; slope; capacity flowing full; design flow; velocity at design flow; flow depth; invert elevation, downstream and upstream; ground elevation, downstream and upstream; and, depth to invert, upstream and downstream. When no obvious errors were noted, a plotted profile utilizing design data was drawn. Cost estimates of various unit cost matrices were computed. The completed report included a listing of pertinent design criteria, input data, system flows, system geometry, design output, quantity takeoff, cost summary by item, total project cost, and plotted design profile. Of four alternatives computed, the city of Phoenix evaluated actual design benefits and relative construction costs and authorized one of the designs. A pitfall of using computer generated designs is that engineers must thoroughly check both input data and output results against good engineering judgment and must understand the limitations of the computer hardware and software itself. (Prague-FIRL)  
W75-10253

#### STATISTICAL ANALYSIS OF OPERATIONAL PERFORMANCE OF SOME PACKAGE PLANTS, Department of Water Affairs, Pretoria (South Africa).

L. G. S. Turvey.  
Water Pollution Control, Vol 74, No 2, p 193, 1975. 2 tab.

Descriptors: \*Waste water treatment, \*Sewage treatment, Statistical analysis, Flow rate, \*Performance, Water pollution, Biological treatment, Efficiencies, Suspended solids, Standards, \*Operations, Treatment facilities, Municipal wastes.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

**Identifiers:** Package plants, Performance evaluation.

A summary is given of the statistical analysis of nineteen package plants treating sewage flows of the range 9 to 455 cu m/day. The packages included biological filtration and activated sludge, mostly using aeration by diffused air. All samples of effluent analyzed were collected between July 1969 and November 1973 from the Transvaal area. Frequency curves for six pollution parameters were drawn. These were four hour permanganate value (PV), free and saline ammonia (NH<sub>3</sub>), chemical oxygen demand (COD), suspended solids (SS), pH value, and nitrate (NO<sub>3</sub>). Curves indicated percent conformances with government standards, and very poor performances were demonstrated. For combinations of parameters, PV and COD, conformance with standards was 37%, for PV and NH<sub>3</sub>, 33%, COD and NH<sub>3</sub>, 31%, PV, COD, and NH<sub>3</sub>, 30%, and PV, COD, NH<sub>3</sub>, and SS, 26%. Such unsatisfactory package plant performance has been attributed to: underdesign; unsatisfactory design; overloading; misuse such as poisoning; poor maintenance; poor supervision; or a combination of these factors. Although package plants provide convenient treatment for new township developments, army camps, and mining communities, their sub-standard performances must be improved if they are to continue in use. (Prague-FIRL)

W75-10256

**PRECIPITATION OF PHOSPHATES IN SEWAGE WITH LANTHANUM: AN EXPERIMENTAL AND MODELLING STUDY,**  
McMaster Univ., Hamilton, (Ontario).

P. B. Melnyk.

Available in microfiche from the National Library of Canada at Ottawa. PhD Thesis, 1974.

**Descriptors:** Water quality control, \*Waste disposal, \*Canada, \*Waste water treatment, \*Phosphates, \*Sewage treatment, Precipitation(Chemical), Recycling.

**Identifiers:** \*Chemical treatment, \*Lanthanum, Great Lakes Water Quality Agreement.

The United States and Canada have designated under the 'Great Lakes Water Quality Agreement' that the discharge of phosphates in sewage to the Great Lakes will be controlled. Chemical treatment by precipitation is the most often used treatment method. Chemical dosage selection is empirical and requires extensive experimental studies to be carried out by individual waste water treatment facilities. The use of lanthanum as a chemical precipitating agent is modelled for the desirable dosage. Lanthanum has been found to be an efficient precipitating agent, causing low residual phosphate concentration, and it can be economically recovered and recycled. The solubility products of lanthanum, ortho-, pyro-, and tripyrophosphate, lanthanum hydroxide and carbonate, and the solubility constants of the hydroxide and polyphosphate ion complexes were measured. A computer program was utilized for predicting the lanthanum dosage required for a particular residual of dissolved phosphates given the water quality of the waste water as expressed in total aqueous concentrations of ortho- and polyphosphates, calcium, magnesium, carbonates, sodium, chloride, sulphates, and pH. (Prague-FIRL)

W75-10259

**A DIMENSIONLESS DESIGN EQUATION FOR SEWAGE LAGOONS,**  
New Mexico Univ., Albuquerque.

T. B. Larsen.

Available from University Microfilms, Inc., Ann Arbor, Michigan 48106, Order No 75-5900. PhD Thesis, 1974, 337 p.

**Descriptors:** \*Sewage lagoons, \*Waste water treatment, \*Equations, Lagoons, \*Sewage treat-

ment, Biochemical oxygen demand, Climatic data, Statistical analysis, Regression analysis, Model studies, \*Design criteria, Computer programs, Computer models.

**Identifiers:** \*Dimensionless equations.

A lagoon design equation was developed based on loading and climatic factors. This dimensionless equation for surface area was based on the results of a one year study of a sewage lagoon. The year was divided into 296 sample periods; for each period data were collected on the chemical, biochemical, and climatic factors associated with the lagoon including biochemical oxygen demand, solar radiation, and wind speed. Stepwise regression analysis was used to determine predictive variables; after regression, the dimensionless products were seen as follows: MOT Number equals SURFACE AREA (SOLAR RADIATION) to the 1/3 power/INFLUENT FLOW RATE (INFLUENT BOD) to the 1/3 power; RED Number equals INFLUENT BOD minus EF-FLUENT BOD/INFLUENT BOD; TTC Number equals WIND SPEED (INFLUENT BOD) to the 1/3 power/(SOLAR RADIATION) to the 1/3 power; TEMPR Number equals LAGOON LIQUID TEMPERATURE/AIR TEMPERATURE; and DRY Number equals RELATIVE HUMIDITY. The model design selected by a computer program for the estimation of non-linear parameters was: MOT = (2.47 to the RED power + 2.47 to the TTC power + 24.9/TEMPR + 150.0/DRY X 1,000,000. This equation is thus used to calculate the lagoon surface area needed to accomplish any desired BOD reduction (RED Number) given climatic data for the geographical area of a specific lagoon location. (Prague-FIRL)

W75-10261

**CALIFORNIA PLANT GETS STRAIGHT 'A'S IN COMPUTER CONTROL,**

San Jose-Santa Clara Water Pollution Control Plant, San Jose, Calif.

F. M. Belick, and F. N. Van Kirk.

Water and Wastes Engineering, Vol 12, No 3, p 20-24, 76-77, March, 1975.

**Descriptors:** \*Computers, \*Water pollution control, \*California, Engineering design, Installation, \*Waste water treatment, Monitoring, Flow data, Analog computers, Personnel, \*Control systems, Treatment facilities.

**Identifiers:** \*Direct digital control(DDC), San Jose/Santa Clara(Calif).

The San Jose/Santa Clara, California, water pollution control plant has been converted from Pneumatic analog control to direct digital control (DDC) with very little difficulty. Design and installation increased the plant capacity from 94 mgd to 160 mgd. Benefits of the DDC system include treatment efficiency, whereby process flow data is fed to the computer and updated every few seconds, achieving clean effluent discharge and flow balances within each unit process, and plant productivity, whereby most DDC control operations are in a central computer room and a larger(160 mgd) plant may be operated with no significant increase in personnel. Additionally, energy is conserved because automatic control of demand for air eliminates provision of excess air, as under a manual control system. Because the computer monitors loading rate of each tank and whether or not a particular one is in use, the flow of chemicals takes place only when they are needed, conserving the amount of chemicals. Moreover, the system has unlimited flexibility; changes in computer control are primarily changes only in software instructions, such as instrument ranges, alarm limits, or trend recording. With DDC, the plant management staff is continually provided with all types of operating information, pre-calculated and displayed graphically in appropriate engineering units, and accessible at an central location for use. (Prague-FIRL)

W75-10267

**RESEARCH ON POLLUTION WITH POLYCHLORINATED BIPHENYLS AND POLYCHLORINATED TERPHENYLS IN SEWAGE PLANTS, (IN JAPANESE),**

T. Kowase, Y. Tsuchiya, Y. Okamoto, K. Yamazaki, and S. Mimura.

Tokyo Eisei Kenkyu Nenho (Annual Report of Tokyo Metropolitan Research Laboratory of Public Health), No 25, p 411-416, 1974. 3 fig, 9 ref.

**Descriptors:** \*Polychlorinated biphenyls, \*Sewage treatment, \*Waste water treatment, Water pollu-

**A COMPUTER COMES TO MISSOURI,**  
Springfield Water Dept., Mo.

R. D. Plank.

Water and Wastes Engineering, Vol 12, No 4, p 54-56, April, 1975.

**Descriptors:** \*Computers, \*Monitoring, \*Treatment facilities, \*Waste water treatment, \*Municipal water, Automation, Data analysis, Measurement, Filters, \*Missouri, Digital computers.

**Identifiers:** Springfield(Mo).

Digital computers are now being utilized to monitor and control the Fulbright water plant at Springfield, Missouri. A Honeywell Vupak on-line data acquisition and process control system monitors 109 separate functions of the municipal treatment and distribution system. Data points measure the total raw water flow into the plant from a reservoir and a spring which is fed from lake watersheds. Three venturi flow devices transmit signals for these measurements. Analog measurements include reservoir, storage tank, and clearwell levels, raw and finished water pH, effluent turbidity at several points, air and finished water temperature, and station pressure. In addition, the computer monitors operation of six mixed-media and dual-media filters, and can initiate backwash from a loss-of-head signal or from effluent turbidity. Water quality is measured in a laboratory and manually entered into the computer in terms of residual chlorine, rising well level, inches of rainfall, chlorine tank weight, odor, color, bacteria, and conductivity. Monthly summaries of data on 79 points throughout the system are logged in. Items tabulated by the computer include total finished water, total wash water, total chemicals, and pump running times. This system has found flaws in the plant's previous measuring and control equipment. The operator need not have technical computer training, thus the system is easy for a water department to handle. (Prague-FIRL)

W75-10265

**CALCULATION OF REACTION MECHANISMS IN FERMENTATION BASINS WITH CONTINUOUS FLOW (ZUR BERECHNUNG VON REAKTIONSABLAUEN IN KONTINUIERLICH DURCHSTROEMTEN FERMENTERBECKEN),**  
E. Adams, M. Boes, L. Hartmann, and H. Spriener.

Wasserwirtschaft, Vol 64, No 10, p 294-301, 1974. 12 fig, 13 ref.

**Descriptors:** \*Sewage treatment, Flow rates, \*Biological treatment, Mathematical models, Equations, \*Fermentation, Treatment facilities, Design criteria, \*Waste water treatment.

**Identifiers:** Germany.

The performance and design of a biological sewage treatment facility with continuous flow is studied mathematically. The plant uses the fermentation process. Data processing and numerical mathematics do not yield reliable approximate solutions for the flows and chemical reactions. Rather, by using the theory of differential inequalities, with rigorous upper and lower bounds, an unknown exact solution of the system is determined. The dependency of the bounds on specific parameters is discussed. (Nave-FIRL)

W75-10267

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

tion, Activated sludge, Effluents, Influent streams, Industrial wastes, Pollution identification.

Identifiers: \*Polychlorinated terphenyls, Coprostanols, Japan.

Research was conducted on pollution by polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs), and coprostanols in sewage treatment plants. When influents, effluents, and activated sludges of some sewage plants were examined, PCBs was detected in all three materials. The maximum value of PCBs was detected in Ukiima, Japan, plant where industrial waste water is treated. PCTs were detected in influents and activated sludges, but not in effluents. The PCTs/PCBs ratio in activated sludges had an average value of 1/17. No correlation between coprostanol and PCBs could be demonstrated; a very slight correlation exists between coprostanol and PCTs. (Prague-FIRL)

W75-10271

#### SEPARATION OF PHENOL FROM WASTE WATER BY THE LIQUID MEMBRANE TECHNIQUE,

Exxon Research and Engineering Co., Linden, N.J.

R. P. Cahn, and N. N. Li.

Separation Science, Vol 9, No 6, p 505-519, 1974. 7 fig, 3 tab, 4 ref.

Descriptors: \*Phenols, \*Waste water treatment, Emulsions, Oil, Mathematical models, Laboratory tests, \*Membrane processes, \*Separation techniques.

Identifiers: Liquid membrane emulsion.

A number of systems have been compared for the removal of phenols from waste waters. The liquid membrane emulsion technique, which involves either oil-in-water or water-in-oil emulsions is described as to its performance in small scale laboratory tests. The impurity in the waste water, such as phenol, permeates across the oil membrane in its undissociated form and is then neutralized by the strong caustic or acid inside the aqueous droplets within the emulsion, thus preventing its escape back out into the waste water. A single-stage installation together with make-up, recycle, and disposal is described. Mathematical relationships are derived for the theoretical distribution and for the rate of permeation of phenol into an emulsion. The method is particularly useful where other techniques fail due to the presence of interfering substances, or very high or very low pH. (Prague-FIRL)

W75-10273

#### PROBLEMS WITH EFFLUENT SEEPAGE FIELDS,

Connecticut Univ., Storrs. Dept. of Civil Engineering.

K. H. Healy, and R. Laak.

Water and Sewage Works, Vol 121, No 10, p 64-67, October, 1974. 9 fig, 6 ref.

Descriptors: \*Seepage control, \*Design criteria, \*Septic tanks, Effluents, Soil contamination effects, Hydraulic conductivity, Soils, \*Connecticut, Path of pollutants, Water pollution sources, \*Soil disposal fields, \*Waste water treatment, Waste water disposal.

Identifiers: Seepage fields, Land application.

A rational method of designing seepage fields was investigated. Of septic tank seepage fields in Connecticut that failed, three quarters of them failed because the ground surrounding the field could not absorb the liquid, and the failures were result of greatly reduced permeability at the soil interface due to biological activity. Design criteria were discussed for land application of an effluent. It was determined that a successful septic tank seepage field must have sufficient soil interface so that effluent application rate does not exceed from

approximately 0.3 gpd/sq ft for clayey or silty soils to 0.8 gpd/sq ft for clean sands and gravels. If a potential hydraulic head of 12 inches can be provided, the sides and bottoms of trenches, beds, or pits can be used to compute this area. Also, if the ground surrounding a seepage field must have sufficient hydraulic conductivity to absorb the liquid faster than it is applied. This is a difficult requirement because the hydraulic conductivity is dependent upon a number of factors; these include existing soil permeability, groundwater elevation, and impermeable boundaries. If the designer is made aware of both the hydraulic conductivity and the soil interface area, he can specify site changes such as drainage or filling and should be able to then allow construction of a seepage field for effluent disposal, applicable to specific cases of subsurface disposal of domestic septic tank effluent. (Prague-FIRL)

W75-10274

#### THE DEVELOPMENT OF A SCHEME TO CONSTRUCT LARGE DIAMETER SEWAGE PUMPING MAINS ACROSS THE RIVER TEES AND THE TEES RAILWAY MARSHALLING YARD,

F. M. Firth.

Chartered Municipal Engineer, Vol 102, No 4, p 72-76, April, 1975. 5 fig.

Descriptors: \*Sewage, \*Waste water treatment, \*Pipelines, Design criteria, Construction materials, Interceptor sewers, Water pollution control, Sewage treatment, Rivers.

Identifiers: \*River Tees(Great Britain), Surge pressure analysis.

Construction of a two stage sewerage scheme has begun on the River Tees, Great Britain, one of the Country's most polluted estuaries. The first stage, to be completed by 1976, is a system of interceptor sewers, gathering flows to a point on the river where there already is a concentration of major sewer outfalls and where available land exists for a new sewage treatment works. The system will service a population of up to 170,000 with a maximum design flow of 3200 liters/sec. A large amount of variation in flow quantity to be pumped is accommodated by two pipelines of 1.0 m bore and one pipeline of 0.7 m bore. Design velocity within the mains is about 2.0 m/sec with a maximum pumping head of 21 m. Design criteria included possible routes of the pipeline with cost optimization, choice of pipeline material, and analysis of surge pressure. (Prague-FIRL)

W75-10275

#### SUBMERSIBLE PUMPS MAKE BY-PASS POSSIBLE,

Los Angeles County Sanitation District, Whittier, Calif.

For primary bibliographic entry see Field 8C.

W75-10276

#### WASTEWATER LIFT STATION OPENS WAY TO URBAN EXPANSION.

For primary bibliographic entry see Field 8C.

W75-10277

#### WATER RESEARCH CENTER UNRAVELS THE NITRATE KNOT,

J. Naughton.

Surveyor, Vol 4285, p 12-16, July, 1974. 6 fig.

Descriptors: \*Nitrates, \*Water pollution, \*Effluent control, \*Sludge disposal, Runoff, Sewage effluent, Industrial wastes, Domestic wastes, \*Waste water treatment, Activated sludge, Biological filtration, Discharges, Clarification.

Identifiers: \*Heterotrophic bacteria, Methanol, Molasses.

The Water Research Center, United Kingdom, has investigated the hazards of nitrates from sewage

effluents and other sources reaching drinking water supplies. An evaluation was made of the different methods of nitrate removal from sewage effluents at the WRC Stevenage Laboratory, summarized by the start of full-scale trials at the Rye Meads Sewage Works on the Lee River. The method developed resulted in savings in treatment costs, and in the capital costs of new works. Sewage and agricultural run-off are the greatest contributors to the nitrate problem. Research at Stevenage concentrated on the flooded filter concept. The method works on the principle that there exists a group of facultative heterotrophic bacteria capable of modifying their metabolism to use nitrate as a source of oxygen when there is no dissolved oxygen. Nitrate removal then can be effected by the deprivation of oxygen to a nitrified effluent, containing these bacteria. An additional source of carbon is needed to achieve an adequate rate of oxygen utilization and denitrification. Molasses and methanol are the cheapest carbonaceous materials for convenient use. Nitrate removals of about 90 percent are achieved with flooded filters, while experiments at low temperatures showed a reduced efficiency in the filters below 10 C. (Leibowitz-FIRL)

W75-10278

#### POLLUTION CONTROL, NEXT STEP, PHYSICAL/CHEMICAL TREATMENT, ACTIVATED CHARCOAL,

McMaster Univ., Hamilton (Ontario).

A. Benedek, and A. B. Redekopp.

Water and Pollution Control, Vol 112, No 9, p 24-26, September, 1974.

Descriptors: \*Activated carbon, \*Waste water treatment, \*Municipal wastes, \*Industrial wastes, Sewage treatment, Tertiary treatment, Adsorption.

The range and type of waste water treatment unit operations have changed little over the last sixty years although the volume and nature of municipal and industrial waste waters have changed radically. Activated carbon adsorption is considered the most important organic removal process to be developed since the advent of the activated sludge process in 1912. Activated carbon is a relatively cheap, non-specific adsorbent with a high capacity for most waste water organics. Activated carbon columns are used as tertiary treatment to remove nonbiodegradable components of waste water. Water that is directly or indirectly recirculated needs to have all possible organic matter removed; activated carbon treatment following biological oxidation is an economical and reliable method for this. Plants are now in operation based on the physical-chemical treatment procedure. Raw sewage entering such plants is chemically clarified with one of the metal coagulants used in phosphorous removal such as alum, ferric or ferrous salts or lime, and a polymeric flocculant. Chemical clarification can remove more than 90% of the suspended solids in sewage. The clarified waste water is fed to activated carbon columns, with or without filtration. The advantages of physical-chemical treatment over conventional treatment included: high organic treatment levels; almost complete suspended solids and phosphorous removal; good removal of most non-biodegradable organics and trace metal ions; low required land levels; low initial capital cost; easy start-up; insensitivity to biological toxins; and, capability of handling highly fluctuating feed concentration. (Orr-FIRL)

W75-10279

#### ZETA POTENTIAL CONTROLS DIRECT FILTRATION COAGULATION,

For primary bibliographic entry see Field 5F.

W75-10280

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

**CHARACTERISTICS OF GAS-LIQUID CONTACT APPARATUS IN OZONE TREATMENT FOR DRINKING WATER, (IN JAPANESE),**  
For primary bibliographic entry see Field 5F.  
W75-10281

**RECYCLE SLUDGE TO FEED FARMS,**  
CH2M/Hill, Denver, Colo.  
J. E. Schwing, and J. L. Puntenney.  
Water and Waste Engineering, Vol 11, No 9, p 24-27, 72, 74, 76, 78, September, 1974. 2 fig, 5 tab.

Descriptors: \*Sludge disposal, \*Fertilization, \*Nutrients, \*Sewage treatment, Anaerobic digestion, Drying, Incineration, Municipal wastes, Application methods, Environmental effects, Irrigation practices, Organic matter, \*Colorado, \*Recycling.  
Identifiers: \*Denver(Colorado).

The Metro Denver Sewage Disposal District No. 1, Denver, Colorado, is expanding and developing a massive sludge disposal system. It will include long distance pumping of sludge slurry, subsurface injection, and air drying of the sludge for crop fertilization. On-site treatment of the sludge at the expanded facilities will consist of air flotation thickening of the waste activated sludge and anaerobic digestion of the combined waste activated and primary sludges for stabilization. Land incorporation of the sludge is currently practiced because it makes possible the reuse of a potentially valuable material for fertilization and eliminates the buildup of nutrients in the treatment system that results from the recycling of sludge. An environmental monitoring program tests core samples from the soil where the sludge is deposited for nutrients, metals, and coliform bacteria. Wheat is planted annually and used as pasture and hay for cattle. The expanded program will make sludge either in a dried or liquid state available to area farmers to use as fertilizer. An upper application limit will be set on each farmer's land depending on the crop grown. The expenditure for the proposed system compares favorably with the cost of the current system and also well with the cost of incineration. (Orr-FIRL)  
W75-10282

**THE IMPACT OF SECONDARY TREATMENT ON WASTES DISCHARGED INTO THE OCEAN.**  
Hearing—Subcomm. on Environmental Pollution—Comm. on Public Works, U.S. Senate, 93d Cong., 2d Sess., March 18, 1974. 425 p, multiple fig, photo, tab.

Descriptors: \*Sewage treatment, \*Federal Water Pollution Control Act, \*Hawaii, \*Municipal wastes, \*Oceans, Pacific Ocean, State governments, Local governments, Water policy, Legislation, Legal aspects, Regulations, Water law, Treatment, Waste treatment, Waste water treatment, Water pollution treatment, Water treatment, Treatment facilities, Disposal, Sewage, Water pollution, Water pollution sources, Federal government.  
Identifiers: \*Administrative regulations, \*Coastal waters, \*Congressional hearings, \*Federal Water Pollution Control Act Amendments of 1972, Environmental policy, Hazardous substances(Pollution).

The impact of secondary treatment on wastes discharged into the ocean is the subject of these Senate Hearings. Particular emphasis is given to Hawaii's problems with the Federal Water Pollution Control Act which requires that municipal waste water facilities utilize secondary treatment by July 1, 1977. Criticism is made of the inflexibility of the Act, for failure to allow exceptions where health, safety and the ecology will not suffer. Some commentators propose amending the Act to allow discretion in granting permission for alternative treatment processes which will produce an equal or better environmental effect. It is sug-

gested that advanced primary treatment is sufficient for some areas of Hawaii. (Fernandez-Florida)  
W75-10321

**IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT.**  
For primary bibliographic entry see Field 5G.  
W75-10322

**STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY—PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR INCOMPATIBLE POLLUTANTS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10323

**MARINE SANITATION DEVICES—PROPOSED CERTIFICATION PROCEDURES AND DESIGN AND CONSTRUCTION REQUIREMENTS.**  
Coast Guard, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10324

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10325

**LIQUID AND CRYSTALLINE CANE SUGAR REFINING SUBCATEGORY—EFFLUENT LIMITATIONS GUIDELINES AND PROPOSED PRETREATMENT STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10326

**INORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10327

**ELECTROPLATING POINT SOURCE CATEGORY; COPPER, NICKEL, CHROMIUM AND ZINC ON FERROUS AND NONFERROUS MATERIALS SUBCATEGORY.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10328

**THERMAL DISCHARGES—PROPOSED PROCEDURES FOR THE IMPOSITION OF ALTERNATIVE EFFLUENT LIMITATIONS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10329

**ASBESTOS MANUFACTURING POINT SOURCE CATEGORY—EFFLUENT LIMITATIONS GUIDELINES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10330

**FERROALLOY MANUFACTURING POINT SOURCE CATEGORY.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10332

**FEEDLOTS POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10333

**GLASS MANUFACTURING POINT SOURCE CATEGORIES—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10334

**THERMAL DISCHARGES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10335

**BUILDERS PAPER AND BOARD MANUFACTURING POINT SOURCE CATEGORY—EFFLUENT LIMITATIONS GUIDELINES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10336

**STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10337

**DURABLE SLURRY PUMPS ARE HEART OF POLLUTION CONTROL FACILITY AT IN-LAND.**  
For primary bibliographic entry see Field 8C.  
W75-10340

**MASS TRANSFER TO NATURALLY FLOWING STREAMS,**  
Delaware Univ., Newark. Dept. of Chemical Engineering.  
V. M. Nadkarni, and T. W. F. Russell.  
Industrial Engineering Chemical Process Design Development, Vol 12, No 4, p 414-416, 1973. 1 fig, 1 tab, 6 ref.

Descriptors: \*Waste disposal, \*Design engineering, Streams, \*Waste water treatment, Mathematical models, Calculations, Estimating, \*Mass transfer.  
Identifiers: \*Oxygen transfer rates.

Before planning a system of waste water disposal to naturally flowing streams, it is necessary for a process design engineer to estimate rates of oxygen transfer which will occur. In 1964, a typical correlation was developed by Downing and Knowles to calculate the mass transfer coefficient. While their method was an empirical one, a simpler semiempirical correlation is presented which is simpler in form and is superior in its agreement with published data. (Prague-FIRL)  
W75-10341

**HIRE AN ACTIVATED CARBON PLANT FOR WASTE WATER TREATMENT,**  
Chemviron S.A., Brussels (Belgium). Technical Dept.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

C. Bailey.  
Progress Engineering, No. 2, p 116-117, February, 1975. 1 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Activated carbon, Oil industry, Chemical industry, Treatment, Organic compounds, Adsorption, Textiles.

Identifiers: Chemviron Adsorption Service, Textile industry, Pharmaceutical industry, Package plants.

The increasingly complex chemical nature of waste streams as well as the more stringent effluent quality requirements has increased the employment of activated carbon treatment systems. A waste water treatment package using activated carbon is offered by Chemviron called the Chemviron Adsorption Service (CAS). The service combines the reliability of carbon adsorption with carbon regeneration and modular engineering. Systems are designed for each specific waste stream. A typical system includes: granular carbon adsorbers; a filtration system; a carbon transfer vessel to assist the periodic carbon replacement; and, pumps and controls. The following classes of compounds are readily adsorbed on carbon: aromatics, phenolics; chlorinated hydrocarbons; surfactants; soluble organic dyes; organic acids; branch-chained aliphatics; and high molecular weight amines. CAS offers an economical treatment process for both large and small firms; it provides guaranteed treatment objectives while involving no major capital investment by the user. Industries now using activated carbon treatment include the textile, petroleum, chemical, and pharmaceutical industries. (Orr-FIRL)  
W75-10346

#### UPGRADING EXISTING WASTEWATER TREATMENT PLANTS—CASE HISTORIES.

Environmental Protection Agency, Washington, D.C. Technology Transfer Staff.  
Seminar Publication, August, 1973. 20 p, 11 fig, 6 tab.

Descriptors: \*Waste water treatment, \*Activated sludge, \*Trickling filters, Nitrification, Biological treatment, Retention, \*Treatment facilities.  
Identifiers: Hydraulic-retention, \*Technology transfer.

Case histories are presented which relate to upgrading the performance of activated sludge and trickling filter plants through modification of the biological processes. In these processes, the biochemical reaction rates depend on the concentration of the wastes and on the appropriate microorganisms capable of feeding on the wastes. Inadequate hydraulic-retention or contact time and solids retention time are the factors which may limit the actual plant performance to a less than optimum level. In addition to the case histories, an outline is presented which lists the process modification or addition and when to use it. The process modifications include: tightening process control; adding final tank capacity; increasing aeration solids level; increasing air supply or improving air distribution; increasing contact time; dividing the reactor into multiple compartments in series; contact stabilization; step aeration; completely mixed activated sludge; positive ventilation; media change; increasing recirculation; activated sludge recirculation; high rate trickling filters; activated sludge; and, a nitrification trickling filter. (Orr-FIRL)  
W75-10347

OZONE CHEMISTRY AND TECHNOLOGY—A REVIEW OF THE LITERATURE: 1961-1974, Franklin Inst. Research Labs., Philadelphia, Pa. Science Information Services Dept.

J. S. Murphy, and J. R. Orr.  
Franklin Institute Press, Philadelphia, Pa, 1975. 392 p.

Descriptors: \*Reviews, \*Ozone, \*Waste water treatment, Publications, Equipment, Instrumentation, \*Bibliographies, Chemistry, Polymers.

Identifiers: Organic chemistry, Inorganic chemistry, Ozonization, Literature reviews.

The worldwide chemistry literature was thoroughly reviewed from 1961 to 1974 for all aspects of ozone chemistry and technology. Eleven state-of-the-art overviews covering nine subject areas comprise the body of the book with over 3,000 bibliographical entries as supportive material. The subject areas include the effects of ozone on vegetation, the effects of ozone on animals, ozone treatment of waste water, ozone in organic chemistry, ozone equipment and instrumentation, ozone involvement in atmospheric chemistry and meteorology, ozone in inorganic chemistry, ozone general chemistry and technical applications, and ozone in polymer chemistry. Thorough subject and author indexes are also included. (Orr-FIRL)  
W75-10348

#### 5E. Ultimate Disposal Of Wastes

##### DISPOSAL OF WASTE STREAMS CONTAINING ASBESTOS,

Dow Chemical Co., Midland, Mich. (assignee)

T. F. Lagess, and V. H. Maudlin.

US Patent No 3,887,462, 4 p, 6 ref; Official Gazette of the United States Patent Office, Vol 935, No 1, p 293, June 3, 1975.

Descriptors: \*Patents, \*Waste disposal, \*Underground waste disposal, \*Waste disposal wells, \*Asbestos, Limestones, Alkaline earth metals.

Identifiers: Settling agents, Waste asbestos.

Waste asbestos carried in aqueous waste streams can be safely disposed of in underground cavities. Problems associated with such method of disposal in underground cavities, from which it may be desired to extract aqueous streams, are overcome by contacting the asbestos with a relatively dense settling agent which attaches to the asbestos and causes it to sink to the bottom of the cavity. The settling agent may be a finely divided rock or mineral, especially one which contains appreciable amounts of alkaline earth metal compounds. In some instances, relatively small amounts of water-soluble or water-miscible organic flocculating agents are added to aid the settling. Care should be taken to avoid aeration of the asbestos slurry because the asbestos, which contains tiny pores and voids, can capture small air bubbles within its fibrous structure and this makes settling more difficult. (Sinha-OEIS)  
W75-09876

##### SEWAGE PLAN WEDS FIVE MUNICIPALITIES,

Parsons, Brinckerhoff, Quade and Douglas, Inc., New York.

For primary bibliographic entry see Field 5D.

W75-09914

##### A MODEL FOR PREDICTING THE EFFECTS OF SEWAGE EFFLUENT ON WETLAND ECOSYSTEMS,

Michigan Univ., Ann Arbor.

For primary bibliographic entry see Field 5B.

W75-09915

UNDERGROUND LIQUID WASTE DISPOSAL. American Society of Civil Engineers, New York. Task Committee on Underground Liquid Waste Disposal.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 101, No HY3, p 421-435, March, 1975. 10 tab, 18 ref.

Descriptors: \*Waste water disposal, \*Industrial wastes, \*Underground waste disposal, Waste disposal wells, Injection wells.

A discussion underground liquid waste disposal includes the following topics: information on the extent and character of underground liquid waste disposal and the status of regulation in the U.S.; assessment of the impact that this disposal is having and will have on the environmental and integrity of groundwater resources; and, recommendation of appropriate courses of action to monitor, control, limit, or prohibit underground liquid waste disposal. Although the chemical industry is the largest user of injection wells, a variety of other industries also have constructed such wells. Most existing wells are between 1,000 and 6,000 feet deep. Ninety-five percent of existing wells have average injection rates of less than 400 gpm and 99 percent inject at average well-head pressures of less than 1,500 psi. Few examples of contamination of fresh groundwater were found. No reported instances of degradation of other resources were found. Waste water with large quantities of dissolved inorganic chemicals are the most likely to be injected. Any future restrictions on injection will include that treatment must be performed prior to injection. The policy of the Ohio River Valley Water Sanitation Commission is presented as a rational basis for control of underground liquid waste disposal. (Orr-FIRL)  
W75-09938

FLUIDIZED-BED INCINERATION OF URBAN SLUDGE (INCINERATION DES BOUES URBAINES EN LIT FLUDISE),  
For primary bibliographic entry see Field 5D.  
W75-09941

##### RESEARCH STATUS ON EFFECTS OF LAND APPLICATION OF ANIMAL WASTES,

Kansas State Univ., Manhattan.

For primary bibliographic entry see Field 5B.

W75-10022

##### GROUND WATER POLLUTION PROBLEMS IN THE NORTHWESTERN UNITED STATES,

Geraghty and Miller, Port Washington, N.Y.

For primary bibliographic entry see Field 5B.

W75-10023

GROUNDWATER POLLUTION BY WASTE DISCHARGE (LA POLLUTION DES EAUX SOUTERRAINES PAR LES DECHARGES),  
For primary bibliographic entry see Field 5B.

W75-10042

AN INTEGRATED SYSTEM FOR DISPOSAL OF SLUDGES ORIGINATING FROM WATER SOFTENING AND SEWAGE TREATMENT IN MUNICIPALITIES, Kansas Univ., Lawrence. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5D.

W75-10123

USE OF LIME-SODA ASH SOFTENING SLUDGE FOR THE TREATMENT OF MUNICIPAL WASTEWATER, Kansas Univ., Lawrence. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5D.

W75-10125

HYDROLOGIC EVALUATION OF THE HAYSTACK BUTTE AREA WITH EMPHASIS ON POSSIBLE DISCHARGE OF CLASS-I WASTES, EDWARDS AIR FORCE BASE, CALIFORNIA, Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 5B.

W75-10161

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Treatment and Quality Alteration—Group 5F

#### DESIGN OF SURFACE WATER OUTFALLS TO RIVERS.

Lothians River Purification Board (Scotland). For primary bibliographic entry see Field 5D. W75-10183

#### DUMPS: A POTENTIAL THREAT TO OUR GROUNDWATER SUPPLIES.

Environmental Protection Agency, Washington, D.C. Office of Solid Waste Management Programs. For primary bibliographic entry see Field 5B. W75-10184

#### SUBSURFACE ENVIRONMENT--PRIVATE PROPERTY OR PUBLIC DOMAIN.

Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center. For primary bibliographic entry see Field 4B. W75-10209

#### THE DAVY JONES GARBAGE DUMP,

Raytheon Co., Portsmouth, R.I. For primary bibliographic entry see Field 5G. W75-10238

#### WATER QUALITY ROUTING OF UNSTEADY RIVER FLOW BY FINITE ELEMENT METHOD,

Osaka Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 5B. W75-10252

#### PROBLEMS WITH EFFLUENT SEEPAGE FIELDS,

Connecticut Univ., Storrs. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W75-10274

#### RECYCLE SLUDGE TO FEED FARMS,

CH2M/Hill, Denver, Colo. For primary bibliographic entry see Field 5D. W75-10282

#### THINK THERMAL,

Envirotech Corp., Menlo Park, Calif. F. P. Sebastian, T. D. Allen, and W. C. Laughlin, Jr. Water and Wastes Engineering, Vol 11, No 9, p 47-48, 50, September, 1974. 2 fig, 2 tab.

Descriptors: \*Sludge disposal, \*Incineration, \*Pollution abatement, \*Sewage treatment, Ultimate disposal, Solid waste, Oxidation, Drying, Burning, Equipment, \*California, Waste treatment.

Identifiers: Furnaces.

Thermal oxidation of sewage sludge is achieving high levels of technology and performance. A task force of the Environmental Protection Agency published a report in 1972 which stated that modern incineration processes were an acceptable alternative for sludge disposal. Sludge incinerator systems designed to meet existing air quality standards produce acceptable stack emissions of nitrogen oxides, sulfur oxides, odors, and particulate matter. The total destruction of PCB, a type of industrial chemical found in sewage sludges which is not biodegradable, is possible when oxidized in combination with sewage sludge. A schematic furnace representation is presented of an advanced design type unit being constructed for the Livermore Water Reclamation Plant, Livermore, California. The top third of the furnace is the drying zone; fresh sludge in this section is dried by the gases from the combustion zone. The middle section of the furnace is where combustion of the dried solids occurs. The remaining ash cools in the lower third of the furnace. Livermore also has

plans for a separate multiple hearth furnace to recalcine or reclaim lime used in the treated process. Sludge incineration by the new methods will contribute less pollutants to the air than the 'clean' car of 1976. Sludge incineration is also an environmentally sound method for disposing of industrial liquid wastes. (Orr-FIRL) W75-10284

#### THE IMPACT OF SECONDARY TREATMENT ON WASTES DISCHARGED INTO THE OCEAN.

For primary bibliographic entry see Field 5D. W75-10321

#### MASS TRANSFER TO NATURALLY FLOWING STREAMS,

Delaware Univ., Newark. Dept. of Chemical Engineering. For primary bibliographic entry see Field 5D. W75-10341

#### 5F. Water Treatment and Quality Alteration

##### DESALTING PLANTS INVENTORY, REPORT

NO. 5, Hawaii Univ., Honolulu. Coll. of Business Administration. For primary bibliographic entry see Field 3A. W75-09852

##### REVERSE OSMOSIS SYSTEM WITH AUTOMATIC VALVE FOR MODULE OPERATION CONTROL,

Desalination Systems, Inc., Escondido, Calif. (assignee) For primary bibliographic entry see Field 3A. W75-09877

##### APPARATUS FOR TREATING WATER CONTAINING IMPURITIES,

Stanley Denki Kabushiki Kaisha, Tokyo (Japan); and Kabushiki Kaisha Inoue Japax Kenkyusho, Kanagawa (Japan). (assignees) For primary bibliographic entry see Field 5D. W75-09884

##### WATER CHLORINATION METHODS,

Capital Controls Co., Inc., Colmar. K. A. Moyer. Water and Sewage Works, Vol 121, No 9, p 64-65, September 1974. 2 fig.

Descriptors: \*Chlorination, \*Water treatment, \*Waste water treatment, \*Chlorine, Equipment, Water quality control, Water purification, Disinfection, Sewage treatment.

Identifiers: Compound loop control.

Chlorination of waste water to destroy pathogenic, disease-producing organisms and avoid other forms of water degradation is used in almost all municipal and industrial water treatment applications. Chlorine gas is considered the best source for almost any chlorination where large volumes of water are to be chlorinated to high levels because it is a pure substance, it lowers pH slightly, is easy to control and apply, and is the cheapest source of chlorine based on pounds of available chlorine. Choosing the proper chlorination system depends on the chlorine demand, the amount of chlorine required to react with the organic and inorganic substances and to kill the bacteria; the chlorine dosage, the amount of chlorine put into the water; the chlorine residual, the amount of chlorine remaining after a specified contact period; and, the flow rate of the water. A water treatment plant that processes water with a constant chlorine demand but that experiences rapid, wide-ranging daily flow variations could use a flow proportion-

ing chlorinator to automatically meter exact amounts of chlorine into the water. When the chlorine demand of the water source varies, it is necessary to use an amperometric instrument to automatically and continuously measure levels of chlorine residual. The best automatic chlorine feeding system is compound loop control. This is needed when both the water flow rate and chlorine demand vary significantly in the body of water being treated. It is a combination of a flow proportioning chlorinator and a chlorine residual control system. (Orr-FIRL) W75-09910

##### WATER TREATMENT WITH OZONE.

Netherlands Patent 32218U/23. Issued November 6, 1974. Derwent Netherlands Patents Report, Vol 47, No 1, p 1, December 31, 1974.

Descriptors: \*Patents, \*Ozone, \*Water treatment, Filters, Activated carbon, Construction materials, Filtration, Waste water treatment. Identifiers: \*Filter beds.

Water is treated with filtration and reduction of the ozone residue steps. The filter bed is described. This is composed of a uniform mixture of granular inert natural or synthetic microporous material, as well as granulated activated carbon of a similar physical nature. The best types of natural or synthetic components are those which are chemically reactive. (Prague-FIRL) W75-09923

##### ASBESTOS IN DRINKING WATER,

Ontario Ministry of the Environment, Toronto. Pollution Control Branch. For primary bibliographic entry see Field 5A. W75-10030

##### FILTRATION OF WATER WITH A HIGH IRON CONTENT,

Viak A.B., Vallingby (Sweden). A. Hult. Effluent and Water Treatment Journal, Vol 14, No 5, p 265-267, May 1974. 3 fig, 2 tab, 2 ref.

Descriptors: \*Groundwater, \*Iron, \*Manganese, \*Filtration, \*Oxidation, Potable water, Water supply, Public health, \*Water treatment, Hydrologic aspects.

Iron is present in groundwater in many countries in amounts greater than 0.2 ppm, or exceeding the standards for potable public water supply. Effects of this excess of iron are a bad taste in the water and staining of laundry. Iron is commonly removed by precipitation through oxidation and filtration. Oxidation may be produced by aeration, sometimes combined with an increase of the pH value, or by adding oxidation agents other than air. Manganese in groundwater causes similar problems. Both field and laboratory investigations are necessary to determine the proper treatment for water containing iron or manganese. Satisfactory results were obtained by filtration of water with a very high iron content when the following factors were considered: suitable gradation of the filter material; choice of suitable alkali; and oxidation during filtration. (Prague-FIRL) W75-10171

##### REPORT OF COMMITTEE ON SURVEY OF GROUND WATER SUPPLIES IN NEW ENGLAND.

New England Water Works Association, Boston (Mass). For primary bibliographic entry see Field 4B. W75-10182

##### LEGISLATIVE HISTORY OF THE SAFE DRINKING WATER ACT,

House, Washington, D.C. For primary bibliographic entry see Field 5G.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F—Water Treatment and Quality Alteration

W75-10186

**DISPOSAL OF WASTE ALUM SLUDGE FROM WATER TREATMENT PLANTS,**  
Malcolm Pirnie, Inc., Paramus, N.J.  
For primary bibliographic entry see Field 5D.  
W75-10195

**EFFECTS OF DEPOSIT RESUSPENSION ON SETTLING BASIN,**  
Kyoto Univ. (Japan). Dept. of Chemical Engineering.

T. Takamatsu, M. Naito, S. Shiba, and Y. Ueda.  
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EE4, Paper No 10705, p 883-903, August 1974. 18 fig, 4 tab, 74 equ, 12 ref.

Descriptors: \*Environmental engineering, \*Setting basins, \*Dispersion, \*Depth, Water treatment, Scour, Estimating, Optimization, Equations, \*Mathematical models, Systems analysis, Waste water treatment, Model studies.

Identifiers: \*Boundary value problems, \*Scouring, Eigenvalues, Dispersion model, Prediction.

Scouring of deposits is one of the major factors in designing sedimentation basins for water and wastewater treatment systems. To express the degree of deposit resuspension, a scouring parameter is introduced into a dispersion model. The parameter is taken into account in one of the boundary conditions of a two-dimensional diffusion equation, which is simplified into a one-dimensional dispersion model. The scouring parameter is related to the longitudinal dispersion coefficient by a model experiment. On the basis of the mathematical expression developed, the existence of the optimum depth of a rectangular settling basin has been theoretically predicted and has been experimentally verified. (Bell-Cornell)  
W75-10213

**ZETA POTENTIAL CONTROLS DIRECT FILTRATION COAGULATION,**  
R. D. Letterman, and R. D. Tanner.  
Water and Sewage Works, Vol 121, No 8, p 62-65, August, 1974. 9 fig, 2 tab, 12 ref. OWRR A-062 ILL(1).

Descriptors: \*Water treatment, \*Filtration, \*Polymers, \*Zeta potential, Polyelectrolytes, Turbidity, Water quality control, Water quality, Coagulation, Pilot plants, Illinois, Waste water treatment.  
Identifiers: \*Direct filtration, Chicago(III).

Currently growing is the practice of designing water treatment plants treating low turbidity water without the conventional sedimentation basins and flocculators and feeding coagulant treated water directly to the filters. The results are presented from a six month study using pilot filters at the Central Water Filtration Plant in Chicago, Illinois, and water from Lake Michigan to demonstrate how particle zeta-potential measurements can be used to determine the cationic polyelectrolyte concentration needed for effective operation of the direct filtration process. The polymers studied, Cat-Floc T, Nalcolyte 607, Nalcolyte 8101, and Magnifloc 570-C, each demonstrated an effective concentration range and an optimum concentration. The effective range corresponded to particle zeta potentials in the range -6 to 26 mv. The optimum concentration corresponded to a zeta potential of about 14 mv. When the optimum polymer concentration was achieved, maximum turbidity removal, maximum head loss development, and a shortened ripening period resulted. The amount of polymer that was required to reach a given particle zeta potential increased slightly as the influent water turbidity rose from 0.6 to 35.0 FTU. The effluent turbidity was independent of the influent turbidity in the effective concentration

range. The rate of head loss buildup depended to a significant degree on the type of polymer utilized but the turbidity was effectively removed by all the polymers studied. (Orr-FIRL)  
W75-10280

**CHARACTERISTICS OF GAS-LIQUID CONTACT APPARATUS IN OZONE TREATMENT FOR DRINKING WATER, (IN JAPANESE),**  
N. Tabata.  
Suido Kyokai Zasshi, No 482, p 16-27, November, 1974. 25 fig, 7 ref.

Descriptors: \*Water treatment, \*Ozone, \*Potable water, Flow rates, Ultraviolet absorption, Flow, Water temperature, Instrumentation, \*Waste water treatment.

Identifiers: Ozonometer, \*Gas-liquid contact.

The chemical and physical behavior of ozone in drinking water was studied during the construction of an efficient reaction bath of drinking water sterilization by ozone. Experiments were conducted using a 5 m resin tube (15 cm in diameter) with several sampling side tubes at different positions for ozone analyses. The ozone was bubbled from the bottom of the tube and water flowed in with either countercurrent or cocurrent motion against the ozone flow. Analyses of ozone were made by a UV absorption ozonometer or by iodometry. Drinking water was boiled to exclude the dissolved chloride ion. The ozone absorption by water was more efficient in the countercurrent experiment than in the cocurrent experiment owing to mixing effect. At a constant ozone flow rate, the dissolved ozone concentration increased with increasing reaction path length for the countercurrent experiment. However, the cocurrent experiment gave an increased concentration (1.5 g/cu m) up to 2 m reaction path length, but no further increase in the concentration was obtained with a longer path length. The water flow rate affected ozone absorption in that the increased flow rate decreased ozone absorption for the cocurrent experiment, but increased flow rate for countercurrent experiment, indicating more vigorous mixing between ozone and water. The decomposition constant of ozone was shown to be dependent on water temperature and water qualities.  
W75-10281

## 5G. Water Quality Control

**MECHANICAL MANAGEMENT OF AQUATIC VEGETATION: ANALYTICAL STUDIES OF UNIT OPERATIONS POTENTIALLY USEFUL IN THEIR PROCESSING,**  
Wisconsin Univ., Madison. Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 4A.  
W75-09861

**MICROBIAL DEGRADATION OF PETROLEUM,**  
Biotechnika International Inc., Alexandria, Va. (assignee).  
E. N. Azarowicz.  
U.S. Patent No 3,856,667, 6 p, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 92, No 4, p 1698, December 24, 1974.

Descriptors: \*Patents, \*Oil pollution, \*Microbial degradation, \*Microorganisms, \*Water pollution control, Water quality control, Oily wastes, Industrial wastes, \*Pollution abatement.

A process for the microbial degradation of petroleum or oil waste materials is comprised of treating the petroleum or oily waste with a strain of *Candida lipolytica* for a sufficient time until degradation has been achieved. The microorganism strains employed have a broad spectrum of degradation capability and are capable of degrading crude

petroleum as well as variety of organic molecules, including aliphatic, aromatic and heterocyclic compounds. The distinct unique advantages are that the non-toxic microorganisms employed are derived originally from edible substances which are not toxic. The process can be used to remove oil spillage on the open sea, on sandy beaches, shingle beaches, rocky coast lines, harbors, and inland waters, or oily waste effluent materials discharged from industrial plants. There is no restriction as to the fraction of petroleum which is degradable. The microorganisms are seeded or dispersed over an oil-spilled area by means of boats, aircraft or other vehicles as appropriate. The mixture employed preferably includes a cellulose absorbent to prevent the oil from spreading. Additive nutrients for the microorganisms are also mixed with the absorbent. (Sinha-OEIS)  
W75-09862

**PROCESS FOR CONTROLLING OIL SLICKS,**  
S. W. Miranda.

U.S. Patent No 3,886,067, 5 p, 4 fig, 1 tab, 10 ref; Official Gazette of the United States Patent Office, Vol 93, No 4, p 1592, May 27, 1975.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Water pollution control, Water quality control, \*Foaming, Polymers, Resins, Skimming, Pollution abatement.

Identifiers: Oleophilic foam.

Oil slicks on surface waters are controlled by applying oleophilic foam material to the slick from a boat or airplane. The foamable liquid can comprise many different components which react to form an oleophilic foam material. The reactants in this spray process are preferably compatible with oil and can react with up to 75 percent by weight of oil. They preferably comprise a pre-formulated polymerizing system adapted to compensate for properties of a wide variety of oils and include a polymerizing agent component and a resin component. These two components when mixed, react at ambient temperature to form solid foam products. In one form the boat or aircraft contains means for separately spraying liquid streams of reactive resin foaming materials onto the water surface to react with and bind the oil to form particles of foam or sponge-like clods which can be skimmed from the water surface. In another embodiment the reactive chemicals are combined on board the craft to form a body of oleophilic foam which is then fed to a chipper and applied to the slick. (Sinha-OEIS)  
W75-09868

**INDUSTRY VIEWPOINT (WATER QUALITY CONTROL),**  
Mobil Oil Corp., New York.

A. R. Aitkins.  
Natural Resources Lawyer, Vol 7, No 2, p 241-247, 1974. 20 ref.

Descriptors: \*Federal Water Pollution Control Act, \*Permits, \*Oil pollution, \*Water pollution, Water pollution control, Legal aspects, Penalties(Legal), Law enforcement, Regulation, Administration, Control, Discharge measurement, Political aspects, Research and development, Planning, Legislation, Water law, Constitutional law, Administrative agencies, Industrial wastes.  
Identifiers: Oil discharges.

The Federal Water Pollution Control Act provides civil penalties for industries which discharge harmful quantities of oil. Section 311 defines a discharge in harmful quantities to include among others any that causes a film or sheen upon the surface of the water. But under Section 402, industrial users can get a National Pollutant Discharge Elimination System permit allowing oil discharges if the permittee is using the best practicable control technology and if he works within the specified permit limits. It is argued that the Congressional intent was to exempt permittees from

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

Section 311 penalties. The Environmental Protection Agency (EPA) and the Coast Guard, however, feel that penalties can be imposed for a sheen even when the discharge is a permissible one quantitatively under Section 402. If the 'sheen' test is to be used permittees should be allowed to show that the discharge either was not harmful or was within the permit quantitative limit. The constitutionality is questioned of the Section 311 penalties which are imposed regardless of the fact that the discharge may have been caused by an Act of God, an act of war, negligence of a third party and other things. The standardization of permits is useful in order to hold permittees to similar standards and avoid capricious application of the law to individual dischargers, but too much standardization can be harmful. (Altuve-Florida)  
W75-09885

**MARINE POLLUTION--LEGISLATION LITIGATION, UNDERWRITING--WHERE ARE WE, WHERE AWAY,**  
Lillick, McHose, Wheat, Adams, and Charles, Los Angeles, Calif.  
J. C. McHose.  
Forum, Vol 10, p 251-298, 1974. 26 ref, append.

Descriptors: \*Pollution abatement, \*Water pollution, \*Water pollution control, \*Oceans, United States, Oil, Oil pollution, Navigable waters, Pollutants, Pollutant identification, Water pollution effects, Water pollution sources, Water pollution treatment, Water, Water quality, Insurance, Legislation, Regulation, Transportation, International commissions, International law, International waters.  
Identifiers: Administrative regulations, State policy, Contiguous zone, Hazardous substances(Pollution), International agreements, NEPA, Refuse Act of 1899, Oil Pollution Act.

Concern over marine pollution of oceans and inland waters is a relatively recent development. The law now prohibits the discharge of oil or hazardous substances into the navigable waters of the United States and the contiguous zone in harmful quantities. Insurance requirements and varied state and federal laws are described. The economic impact of present legislation and proposed regulations pose a strangulation threat to the marine transportation industry. A suggested solution is a return to the principle of international uniformity in maritime law. The way to accomplish this in the field of marine pollution is by international conventions, ratified, adopted, recognized and followed by the United States, preempting individual states from enacting legislation in this field. (Gagliardi-Florida)  
W75-09887

**BENEFICIAL USES OF WASTE HEAT,**  
International Atomic Energy Agency, Vienna (Austria).  
O. Ilari, A. Antonelli, and G. Boeri.  
Available from the National Technical Information Service, Springfield, Va. 22161, as RT PROT-74 10, \$4.00 in paper copy, \$2.25 in microfiche. International Atomic Energy Agency, Vienna, October 23-27, 1972. 49 p, 7 fig, 2 tab, 27 ref.

Descriptors: \*Water pollution, \*Nuclear powerplants, \*Thermal pollution, \*Rivers, Cooling water, Atmosphere, Distribution, Fossil fuels, Environmental effects, Beneficial use.  
Identifiers: \*Thames River.

The thermal effluents released into the environment by the electricity generating power stations represent a substantial fraction of the total waste heat rejected into the environment by human activities. A table shows the various percentage contributions to the total heat addition into the water of the Thames at its estuary. From this table it can be seen that condenser cooling water from power stations contributes about three quarters of the total heat added to the river water. The problem of

thermal pollution of the waters is particularly serious in the case of nuclear power stations, because their energy conversion efficiency is presently lower than that of fossil-fueled power plants, and because the waste heat rejected from nuclear power stations is not distributed between the atmosphere and the water. (Houser-ORNL)  
W75-09889

**A GENERAL LINEAR APPROACH TO STREAM WATER QUALITY MODELING,**  
IBM Federal Systems Div., Gaithersburg, Md.  
For primary bibliographic entry see Field 5B.  
W75-09917

**JOINT TREATMENT OF PULPING AND MUNICIPAL WASTES,**  
Procter and Gamble Co., Cincinnati, Ohio. Environmental Control Section.  
For primary bibliographic entry see Field 5D.  
W75-09928

**POLLUTION ABATEMENT IN THE PHARMACEUTICAL INDUSTRY,**  
National Environmental Research Center, Edison, N.J. Industrial Waste Treatment Research Lab.  
For primary bibliographic entry see Field 5D.  
W75-09931

**TREATMENT OF AQUEOUS WASTE STREAMS WITH HYDROGEN PEROXIDE TO REMOVE CHLORINATED ISOCYANURATES THEREFROM,**  
FMC Corp., New York. (assignee).  
For primary bibliographic entry see Field 5D.  
W75-09939

**DRAINAGE SYSTEM COOPERATES WITH NATURE,**  
Woodland Development Corp., Houston, Tex.  
For primary bibliographic entry see Field 4A.  
W75-09942

**QUANTITATIVE ERROR ANALYSIS OF NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS,**  
Rutgers - the State Univ., New Brunswick, N.J. Dept. of Computer Science.  
For primary bibliographic entry see Field 6G.  
W75-10003

**PROCEEDINGS OF PUBLIC FORUM ON WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN SOUTHWESTERN MINNESOTA.**  
Minnesota Univ., St. Paul. Water Resources Research Center.  
For primary bibliographic entry see Field 6B.  
W75-10006

**PROCEEDINGS OF PUBLIC FORUM ON WATER RESOURCES PROBLEMS IN SOUTHEASTERN MINNESOTA.**  
Minnesota Univ., St. Paul. Water Resources Research Center.  
For primary bibliographic entry see Field 6B.  
W75-10007

**RESEARCH NEEDS AS RELATED TO THE DEVELOPMENT OF SEDIMENT STANDARDS IN RIVERS,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
J. Gessler.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 776, \$3.75 in paper copy, \$2.25 in microfiche. Colorado Environmental Resources Center, Fort Collins, Completion Report Series, No 60, May

1975, 35 p. OWRT A-025-COLO(1) 14-31-0001-4006.

Descriptors: \*Research priorities, Sediments, Standards, Water quality, Rivers, \*Water quality standards, Biota, Geomorphology, Hydrology, \*Sediment distribution, Sedimentation.

Identifiers: \*Research needs, \*Sediment standards.

Standards for the sediment load in rivers and streams must be set and enforced at the tributary streams, else it becomes impossible to locate important sediment sources. Such standards need to be very sophisticated and must relate to the full grain size distribution of the moving sediment for geomorphic and biotic reasons. Such standards must be related to a few key parameters: the hydrology; the geomorphology; and the biota of the river. Each of these factors may not vary significantly within one region. Furthermore, the first two are so highly correlated that a separation may not be necessary. Instead of mapping each stream it may then be sufficient to map regions. Any combination of geomorphic and biotic characteristics of the region would then determine the standards applicable to the region's streams. (Evans-Colorado State)  
W75-10013

**MANAGEMENT PRACTICES AFFECTING QUALITY AND QUANTITY OF IRRIGATION RETURN FLOW,**  
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.  
L. G. King, and R. J. Hanks.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-242 827, \$6.25 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-660/2-75-005, April 1975. 155 p, 27 fig, 54 tab, 15 ref, 2 append. EPA 1BB039, S801040.

Descriptors: \*Irrigation, \*Return flow, \*Drainage, \*Salinity, \*Model studies, \*Soil water movement, Nitrogen, Sprinkler irrigation, Management, Water quality, Fertilization, Tile drains, Path of pollutants, Water pollution sources.

Field and laboratory research was conducted to determine the effects of irrigation management and fertilizer use upon the quality and quantity of irrigation return flow. The total seasonal discharge of salts from the tile drainage system was directly related to the quantity of water discharged, because the solute concentration of the ground water was essentially constant over time. Under such conditions, reduction of salt content of return flow is accomplished by reduced drain discharge. Irrigation management for salinity control must be practiced on a major part of a particular hydrologic unit so that benefits are not negated by practices in adjoining areas. Field studies and computer models showed that salts may be stored in the zone above the water table over periods of several years without adversely affecting crop yields on soils with high 'buffering' capacity as encountered in this study. However, over the long term, salt balance must be obtained. Appreciable amounts of nitrate moved into drainage water at depths of at least 106 cm from the applications of commercial fertilizer and dairy manure to ground surface. Submergence of tile drains in the field reduced nitrate concentrations in the effluent, especially under heavy manure applications. (EPA)  
W75-10019

**MEASURING EXTERNAL EFFECTS OF SOLID WASTE MANAGEMENT,**  
Institute for Policy Analysis, La Jolla, Calif.  
For primary bibliographic entry see Field 5B.  
W75-10024

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

#### COOPERATION COMBATS OIL SPILLS IN NORTH CAROLINA.

Fueloil and Oil Heat, Vol 34, No 2, p 24-25, February 1975.

Descriptors: \*Oil spills, \*Water pollution control, Costs, Equipment, Planning, \*North Carolina. Identifiers: Oil boom, Oil skimmer, Oil spill protection.

Oil spill control in Randolph County, North Carolina has been incorporated into the county Rescue Squad operation. The Randolph County Oil Dealers Association decided in the spring of 1974 to plan for protection against major oil spills, and that members should cooperatively purchase pollution control equipment. Out of 29 area fuel dealers, 25 contributed to the project. The members have purchased a trailer with boom, skimmer, and oil absorbent, costing a total of \$8000. A test using styrofoam pieces to represent oil was demonstrated for the public on Dula Lake; the entire clean-up was performed by rescue squad members, with dealers assisting only. The Ashe-Rand Rescue Squad has trained 25 of its members specifically for the use of oil spill containment equipment. In the event of a spill, the dealer responsible for the accident will pay for materials used, such as absorbent foam or fuel. (Prague-FIRL)

W75-10039

#### GEOGRAPHICAL ANALYSIS OF OIL SPILL POTENTIAL ASSOCIATED WITH ALASKAN OIL PRODUCTION AND TRANSPORTATION SYSTEMS.

Battelle-Pacific Northwest Labs., Richland, Wash.

W. H. Swift, R. E. Brown, L. V. Kimmel, M. M. Orgill, and P. L. Petersen.

Available from the National Technical Information Service, Springfield, Va. 22161 as AD-784 099, \$8.50 in paper copy, \$2.25 in microfiche. Report No CG-D-79-74, February 1974. 273 p, 55 fig, 56 tab, 189 ref. DOT-CG-23223-A.

Descriptors: \*Oil pollution, \*Oil spills, \*Environmental effects, \*Transportation, Demand, Oil industry, Alaska, Earthquakes, Oil fields, Arctic, Water pollution control, Probability, Routing, Climatic zones, Ocean currents, Tides.

With the anticipated increase in oil production, practically every mile of the mainland Alaska coastline will be subject to potential oil spills. The hostile environment of Alaska and the remoteness of most potential production areas makes the cleanup of offshore oil spills difficult to impossible for the U.S. Coast Guard, whose mission includes the prevention and control of oil spillage. In order to aid the long-range development of policy and technology to deal with problems associated with oil spills in Alaska, a discussion of the future of crude oil demand and transportation, the environmental conditions in potential spill areas, the expected behavior of oil in spill areas, and spill potential are discussed. The incidence of oil spills is a function of the location and amount of crude oil produced, production methods, the mode and route of transportation, the type and frequency of intermodal transfers, and the geographic and environmental setting of all handling operations. Recommendations to the Coast Guard include a review of present capabilities with emphasis on aircraft potential for detection and control of spills in the future, and the acquisition of a more extensive understanding of true environmental consequences of a spill. (Becker-Wisconsin)

W75-10121

#### MEASURES FOR THE RESTORATION AND ENHANCEMENT OF QUALITY OF FRESH-WATER LAKES.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5C.

W75-10122

#### ECONOMIC INSTITUTIONS TO DETERMINE WATER QUALITY,

Clemson Univ., S.C. Dept. of Economics.

J. B. Eastman.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 914, \$5.25 in paper copy, \$2.25 in microfiche. M.A. Thesis, May 1973. 114 p, 10 fig, 1 tab, 57 ref. OWRT A-030-SC(1).

Descriptors: \*Institutions, \*Resource allocation, \*Water law, \*Water rights, \*Water quality, \*Economic efficiency, Economics, Marginal costs, Marginal benefits, Riparian rights, Appropriate rights, Interstate compacts, Regulation, Water Quality Act, Rivers and Harbor Act, Ohio River, Discharge(Water). Identifiers: Genossenschaften, Property rights.

Existing and proposed economic and political institutions designed to allocate water quality rights are discussed. Criteria which a workable allocative system should meet were determined and existing and proposed allocative institutions were evaluated in light of those criteria. A full property rights system is proposed as a solution to the problem of determining optimum water quality

W75-10132

#### LOW-FLOW CHARACTERISTICS OF WISCONSIN STREAMS AT SEWAGE-TREATMENT PLANTS,

Geological Survey, Madison, Wis.

For primary bibliographic entry see Field 5B.

W75-10163

#### PROCEDURE FOR EVALUATING ENVIRONMENTAL IMPACT,

Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 6G.

W75-10164

#### EASING OF ENVIRONMENTAL LAWS,

F. E. Haarhoff.

Factory, Vol 7, No 11, p 29-35, November 1974. 7 fig, 3 tab.

Descriptors: Pollution abatement, \*Industrial wastes, \*Pesticides, \*Regulations, \*Legislation, Ozone, Sewage treatment, Water purification, Waste water treatment, Public health, Potable water.

Current controversy over pollution control and abatement involves warnings from many people on the dangers of relaxing air and water standards, while many industry spokesmen urge the loosening of environmental rulings as an anti-inflation measure. Industry leaders are asking the government to weigh the public benefits from the regulatory programs against the public costs such as price increases resulting from passing on the costs of pollution abatement programs and jobs lost from the diversion of funds from installation of production plants. The EPA took 2846 enforcement actions against violators of water, air and pesticide laws between January, 1973, and March, 1974; fines and penalties imposed on polluters since December, 1970, total over \$8,200,000. The EPA has developed an effective, quick-acting enforcement team to insure that the environmental laws will achieve cleaner air and water and safer use of pesticides. Industries have realized the penalties for polluting and have begun long-range plans of pollution abatement. The majority of companies responding to a recent survey of industrial pollution control expenditures state that neither future energy conservation programs nor higher energy prices will have significant effects on their long-range anti-pollution efforts. Some of industry's newest pollution control techniques will have applications also for sewage and water treat-

ment. Ozone may soon replace chlorine as the acceptable water purifier. Ozone the treatment of effluent water from a sewage plant is able to economically meet Public Health Service requirements for potable water. (Orr-FIRL)

W75-10173

#### NEEDED: \$350 BILLION - AND A NEW NEEDS SURVEY,

For primary bibliographic entry see Field 5D.

W75-10174

#### LET'S TRY 90% FIRST AND SEE WHAT OUR QUALITY IS LIKE,

Wesleyan Univ., Middletown, Conn. Industrial Waste Lab.

J. W. Masselli, N. W. Masselli, and M. G. Burford. Textile Industries, Vol 138, No 10, p 32-33, 35, 145, October 1974. 1 tab, 4 ref.

Descriptors: \*Pollution abatement, Standards, \*Legislation, \*Water quality control, Regulation, Pre-treatment, Biochemical oxygen demand, Chemical oxygen demand, Phenol, Sulfide, Color, Industrial wastes, \*Water quality standards. Identifiers: \*Combined municipal-industrial treatment.

The problems and increased cost of analytical testing and pollution abatement associated with the Effluent Guidelines and Standards, published by the Environmental Protection Agency on July 5, 1974, are discussed. The BOD requirements are considered too stringent and impractical and unattainable except at great cost. COD should not be a required parameter because the mercury and silver used in the analysis may cause more harm to the ecology and economy than the large volume of organic wastes being investigated. Phenol should not have been considered a separate parameter because it is rapidly oxidized and completely removed in the activated sludge process. For the same reason, sulfide should not be a separate parameter. The APHA color determination is difficult and confusing. Color determinations or color removal should not be required except when the color of the receiving stream is significantly altered visually. This listing of many parameters results in increased costs. The ruling that COD, phenol, sulfide, and oil and grease are incompatible water pollutants which will interfere with the operation of municipal treatment plants is incorrect since these substances are now being treated in activated sludge plants without lowering efficiency. Following this regulation means that essentially double treatment will occur as the plants must pretreat their wastes before joint treatment is allowed. The neutralization of an alkaline pH is also unnecessary and even disadvantageous. (Orr-FIRL)

W75-10175

#### REGIONAL AUTHORITIES TAKE OVER BRITAIN'S WATER/SEWAGE SYSTEMS,

For primary bibliographic entry see Field 6E.

W75-10176

#### LACK OF PROMISED FEDERAL FUNDS HAM-PERS WATER CLEANUP EFFORT.

Engineering News-Record, Vol 193, No 15, p 24-25, October 1974.

Descriptors: \*Waste water treatment, \*Facilities, \*Legislation, \*Federal Water Pollution Control Act, Costs, Financing, Storm runoff, Urban runoff, Sewage treatment, Federal jurisdiction, Government supports, Government finance.

Cities in the U.S. are faced with the problem of how to meet the regulations of the 1972 Federal Water Pollution Control Act. Difficulties in obtaining equipment, material shortages, rapidly escalating prices and the lack of promised federal funds all place limits on cities' ability to spend money ef-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

fectively. The federal government is to provide 75% of the cost of municipal treatment works; this limits the number of projects that can be funded because of the limited amount of money available. The 1974 survey of needs for municipal waste water treatment works released in September 1974, lists a total of \$114 billion needed to meet 1983 clean water standards (excluding storm water treatment and/or control). The EPA expects to allocate only \$3.5 billion for fiscal year 1975. There is a debate between the federal government and cities and states over the cost of controlling the pollution caused by storm water runoff. Chicago, San Francisco, Atlanta and Boston report multi-million dollar needs for pollution control facilities for storm water treatment. They plan to build deep tunnel systems, catchment basins, or other storm water control works. However, most of these storm water plans rate so low on the EPA priority list that they don't receive any federal funds. The agency will not fund storm water facilities until state and local agencies show that they are necessary to meet 1977 standards. (Orr-FIRL)

W75-10178

#### WATER POLLUTION LAW DRAWS FLOOD OF COMPLAINTS.

Chemical Week, Vol 115, No 16, p 37, October 1974.

Descriptors: \*Federal Water Pollution Control Act, \*Industrial wastes, \*Municipal wastes, \*Costs, Government finance, Regulation, Pollution abatement, Water pollution control, Legislation.

Identifiers: \*PL 92-500.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) were criticized by both industry and municipal spokesmen at the Water Pollution Control Federation Conference in Denver during October, 1974. Chief complaints included: the requirement for uniform controls on discharges even though differences in local situations and operations may exist; the large role of the federal government; the lack of adequate financing to meet the goals; the minimal allocations for research; and, the provision which requires municipalities to recover new treatment plant costs in proportion to industrial wastes treated. One basic fault with PL 92-500 is that it is not cost-effective and the goals are not realistic. It is hoped that the National Commission on Water Quality which must report to Congress by October, 1975, will recommend changes in the law which will eliminate the current problems. (Orr-FIRL)

W75-10179

#### GROUND-WATER'S ROLE IN WATER QUALITY MANAGEMENT,

Pennsylvania Dept. of Environmental Resources, Harrisburg. Bureau of Water Quality Management.

J. O. Osgood.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 101, No HY3, p 517-521, March 1975.

Descriptors: \*Groundwater, \*Water quality control, State jurisdiction, Water management(Applied), Surface waters, Water pollution, Hydrogeology, \*Pennsylvania, Administration, Water quality standards.

Identifiers: Gasoline spills.

Federal legislation requires each state to protect the quality of its surface waters, yet this protection is stated only indirectly for subsurface waters. Because surface waters/groundwater evaluation must be integrated in water quality monitoring, the state of Pennsylvania was one of the first to design a Comprehensive Water Quality Management Plan (COWAMP) to protect groundwater as a vital resource. Over two-thirds of that state's public water supply and 99% of its private water supplies are dependent upon groundwater. The slow migra-

tion of contaminated surface water has been demonstrated to cause groundwater pollution. Examples of this are landfill leachate, leaking industrial water impoundments, gasoline spills flushed to the soil, improperly developed spray irrigation sites, and urban runoff infiltration. The COWAMP plan considers groundwater in its role as a major water supply, including new developments in well construction. Groundwater is also seen as a transporting medium for contaminant dispersion; for example gasoline spills move on top of the water table and fumes may migrate up through the soil into buildings as it flows. Additionally, activities affecting the recharge/discharge balance influence waste water treatment and related costs. COWAMP hopes to identify existing hydrogeological characteristics, to study man's impact on existing resources, and to evaluate alternatives. This involves considering areas of poor water quality, areas requiring special protection, such as recharge zones, important watersheds, large population centers, and areas where major population growth is predicted. (Prague-FIRL)

W75-10180

#### LEGISLATIVE HISTORY OF THE SAFE DRINKING WATER ACT,

House, Washington, D.C.

P. N. Kyros.

Journal of the American Water Works Association, Vol 66, No 10, p 566-569, October 1974. 4 fig.

Descriptors: \*Public health, \*Potable water, \*Water supply, Standards, \*Legislation, Regulation, Water quality control, Water purification, \*Water quality standards, \*History.

Identifiers: \*Safe Drinking Water Act.

A brief history of the Safe Drinking Water Act, the need for such legislation, some of the legislative obstacles encountered, and the major provisions of the final bill are discussed. Federal legislation concerning the safety of drinking water has been in the House since 1970. The need for such a bill was highlighted by many newspaper reports of concern over the quality of water and a HEW study conducted in 1969 and 1970 which concluded that approximately 5.4% of all US citizens were being served substandard water from approximately 5000 community water systems. Federal standards have been in effect since 1974 concerning the quality of potable water provided on interstate carriers and standards are now necessary to cover all aspects of water quality. Obstacles encountered included objections letting the EPA administer such a project, loss of interest after the Water Pollution Control Act of 1972 was passed, and the difficulty in knowing exactly what to legislate for or against. The Safe Drinking Water Act provides for the control of underground-injection programs to protect against endangering drinking water sources. Under this bill, the states will have the primary enforcement responsibility to monitor and inspect community water systems to assure their compliance with federal standards; the states will also have the power to grant variances to systems because of the characteristics of the raw-water source or because a required treatment technique is not necessary. Federal funds for research and demonstration projects also are part of the bill. (Orr-FIRL)

W75-10186

INTERNATIONAL CONFERENCE ON THE CONSERVATION OF WETLANDS AND WATERFOWL.

For primary bibliographic entry see Field 6G.

W75-10198

#### MEAN ESTIMATE DEFICIENCIES IN WATER

##### QUALITY STUDIES,

McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.

B. J. Adams, and R. S. Gemmell.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 101, No HY7, p 989-1002, July 1975. 6 fig, 10 equ, 44 ref.

Descriptors: \*Water management(Applied), \*Water quality control, \*Stochastic processes, \*Simulation analysis, Mathematical models, Variability, Planning, Design, Evaluation, Performance, Economics, Standards, Equations, Systems analysis, Waste water treatment, Estimating.

Identifiers: Sensitivity.

Mathematical models are employed in the design, performance prediction, and evaluation of alternative water quality management programs. Examined is the relative influence of deterministic and stochastic models on water quality management decisions to demonstrate some deficiencies of decisions based on mean estimates produced by deterministic models. Water quality management problems are studied which consider the implications of variability in waste generation, treatment plant performance, and receiving water behavior on the resulting variability of water quality. An example is provided in an evaluation of regional wastewater management alternatives given by the size, number, and location of regional treatment plants. It is concluded that an evaluation of water quality management alternatives without consideration for their performance variability may be so deficient as to negate the evaluation. (Bell-Correll)

W75-10202

#### OBJECTIVES OF WATER QUALITY PLANNING,

Kansas Water Resources Board, Topeka.

K. S. Krause.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 101, No HY3, Paper No 11200, p 471-476, March 1975.

Descriptors: \*Water resources, \*Planning, \*Water quality control, Hydraulics, Decision making, Land use, Natural resources, Conservation, Irrigation, Education, Public health, Environment.

Planning is a useless effort if it does not produce a viable procedure for reaching its objectives. Our political process is presently attuned to crisis reaction, producing short-range decisions and simplistic solutions to problems which often serve to confuse and delay the adoptions of hard viable solutions. The control of water quality is a noble objective in itself; however, the need for it is symptomatic of a much deeper and profound disease that must be cured or prevented before a completely successful water quality control program can be achieved. The disease is that of 'living beyond our resource means'. To overcome this, the national objectives should be to: (1) minimize natural resource waste; (2) protect the public health and ecosystems; (3) provide for a system of control that has a practical probability of being achieved; and (4) provide for a positive decision-making process that leads to the rapid consumption of the objectives previously stated. (Bell-Correll)

W75-10205

#### OPTIMAL CONTROL OF WATER POLLUTION IN A RIVER STREAM,

Alberta Univ., Edmonton. Dept. of Electrical Engineering.

V. Gourishankar, and R. L. Lawson. International Journal of Systems Science, Vol 6, No 3, p 201-216, March 1975. 9 fig, 2 tab, 30 equ, 7 ref.

Descriptors: \*Water pollution control, \*River systems, \*Optimization, Biochemical oxygen demand, Dissolved oxygen, Effluents, Organic wastes, Biodegradation, Environmental control, Costs, Waste disposal, Waste treatment, Industrial wastes, Equations, Mathematical models, Systems analysis.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Identifiers: \*Multi-cost system optimization, Performance criteria, Artificial aeration, Dumping, Treated waste.

The application of optimal control techniques to ecological systems is discussed. Specifically, the control of pollution of water in a river stream is considered. The variables to be controlled are the concentration of biochemical oxygen demand and the level of dissolved oxygen. To achieve this, a procedure is presented for controlling dumping of industrial effluents and/or artificial aeration. A realistic determination of the optimum values of these controls is subject to several performance criteria relating to water quality. Since some of these criteria are contradictory, the problem is considered from the point of view of a multi-cost system. A lumped parameter state variable model is derived. Recently published theory on multi-cost system optimization is utilized, and numerical examples are presented. This procedure, which accounts for all the costs simultaneously, has an added advantage over existing methods in that not only can a linear combination with undetermined weighting factors be treated, but other functions of the costs can also be used. (Bell-Cornell) W75-10206

**STATISTICAL EVALUATION OF REAERATION PREDICTION EQUATIONS,**  
Tufts Univ., Medford, Mass. Dept. of Civil Engineering.

L. C. Brown.

Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EES, Paper No 10849, p 1051-1068, October 1974. 5 fig, 6 tab, 13 equ, 21 ref.

Descriptors: \*Water pollution control, \*Statistical methods, \*Atmosphere, \*Mathematical models, \*Environmental engineering, Regression analysis, Sanitary engineering, Least squares method, Equations, Hydraulics, Natural streams, Data collections, Systems analysis, Forecasting. Identifiers: \*Reaeration coefficient, Prediction error, Oxygen transfer.

The object of much of the experimentation in atmospheric reaeration of natural streams is to develop models for predicting the reaeration coefficient  $k_{sub 2}$ . These prediction equations are statistical correlations of the hydraulic variables and fluid properties thought to be important in affecting  $k_{sub 2}$ . Two previously reported models for predicting  $k_{sub 2}$  are reevaluated in the light of these criteria. Although the models are useful for estimating  $k_{sub 2}$ , they do not adequately describe the variation in the observed data because their prediction error is significantly larger than the experimental error. Finally, the two statistical models are used to predict  $k_{sub 2}$  from data from a third, independent source. The prediction error varies between a factor of 2-3 about the predicted value. Comparison with values predicted by a model founded in the penetration theory for gas absorption is favorable. This suggests that theoretical models hold more promise than empirical correlations as a source for equations to predict  $k_{sub 2}$ . W75-10211

**RECOMMENDATIONS FOR ENVIRONMENTAL ENGINEERING EDUCATION,**  
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 9A. W75-10218

**SHORTCUT METHODS TEST ALGICIDES,**  
Wisconsin Univ., Madison.  
G. P. Fitzgerald.  
Water and Sewage Works, Vol 121, No 9, p 85-87, September 1974. 5 tab, 12 ref.

Descriptors: \*Algae, \*Algal control, \*Algicides, \*Copper, Analytical techniques, Algal toxins, Phosphorus, Water treatment, Copper compounds, Water pollution control, Pollutant identification.

Rapid methods have been developed to determine the effectiveness of algicide applications. The effectiveness of various algicides can be demonstrated within one day's time by measurements of the ability of the algae to absorb PO4-P; dead algae do not absorb phosphorus. The previous procedure involved waiting at least a week and measuring the algae growth. The procedure designed can be adapted to planktonic algae, filamentous algae, or aquatic plants. The procedure combines nutritional tests for phosphorus with algicide applications to determine the relative effectiveness of algicides. The effect of various dosages of chemicals over different time periods on the ability of algae to absorb phosphorus or the phosphorus content of the algae were correlated with the death of the algae as determined by growth tests. The results of experiments performed using different copper products as algicides showed that: this test could be utilized to evaluate the relative effectiveness of algicides under different environmental conditions such as duration of treatment, pH, water hardness, or the presence of silt or dissolved organic matter; either the concentration of algicide or the treatment duration can be regulated to produce an effective treatment; the source of copper used as the algicide will determine the treatment duration or concentration required for a particular level of effectiveness; and, the minimum amount of algicide to be effective is related to the amount of algae present and is not related to the volume in which the algae are suspended. (Orr-FIRL) W75-10234

**A CONCEPT FOR MANAGING WASTE,**  
Gulf Waste Disposal Authority, Houston, Tex.  
For primary bibliographic entry see Field 5D. W75-10236

**THE DAVY JONES GARBAGE DUMP,**  
Raytheon Co., Portsmouth, R.I.  
G. V. Cox.  
Environmental Science and Technology, Vol 9, No 2, p 108-111, February 1975. 6 tab.

Descriptors: \*Oceans, \*Waste disposal, \*Municipal wastes, \*Industrial wastes, Pollution abatement, Radioactive wastes, Organic compounds, Waste discharges, Water pollution effects, Environmental effects, Legislation, Heavy metals.

Identifiers: Ocean disposal, Petrochemicals.

Ocean disposal of municipal and industrial wastes has been strongly opposed, particularly by residents of Delaware, Florida, and New York. Recent legislation, such as the Marine and Sanctuaries Act of 1972 (P.L. 92-532) is discussed. In the fall 1972, an International Convention on the Prevention of Marine Pollution by Dumping of Wastes was held which specified certain materials which could not be released and restrictions on the quantities of other materials. The process of application and granting of permits to release wastes to marine waters is complicated, and involves regional jurisdiction of the EPA. Ocean dumping criteria include materials which are absolutely prohibited, such as high-level radioactive wastes, biological, chemical or radiological warfare agents, or persistent inert synthetic or natural floating materials; materials prohibited in other than trace quantities, such as mercury, cadmium, organohalogens, and oils and greases; strictly regulated materials, including petrochemicals, organic chemicals, and organic processing wastes, inorganic processing wastes, biocides, immiscible materials, and other wastes which might cause hazard to navigation. Types of ocean dumping permits are detailed. The pollution and ocean impact

by ocean outfalls discharging sludge is also compared with potential hazards of ocean dumping of wastes. (Prague-FIRL) W75-10238

**DESIGN FOR SOLVENT RECOVERY,**  
Chem-Pro Equipment Corp., Fairfield, N.J.  
For primary bibliographic entry see Field 5D. W75-10239

**EXTRACTION OF PETROLEUM HYDROCARBONS FROM OIL-CONTAMINATED SEDIMENTS,**  
Maryland Univ., College Park. Dept. of Microbiology.  
J. D. Walker, R. R. Colwell, M. C. Hamming, and H. T. Ford.  
Bulletin of Environmental Contamination and Toxicology, Vol 13, No 2, p 245-248, 1975. 2 tab, 4 ref.

Descriptors: \*Oil wastes, \*Solvent extractions, Marine microorganisms, Water pollution control, \*Biodegradation, Estuaries, Separation techniques, Organic compounds, Oil pollution, Chesapeake Bay, Sediments, Waste water treatment, Maryland.

Identifiers: \*Petroleum hydrocarbons, \*Benzene, Colgate Creek(Md).

The degradative capabilities of naturally-occurring microorganisms in Chesapeake Bay are assessed by sampling on a regular basis. One area, that of Colgate Creek, is contaminated with petroleum compounds, including cosmoline (a wax used to protect automobiles during Atlantic transport), kerosene (used to wash wax from the automobiles), motor oil, and tanker fuels. A study was conducted to determine whether or not a correlation exists between numbers of petroleum-degrading microorganisms with amount of petroleum-like material routinely extracted from sediment. In addition, a comparison is made of several methods and solvents for extraction of estuarine water and marine sediments. Comparison of the amount and proportional representation of each component extracted, as determined by mass spectrometry, indicated that the material contained the hydrocarbons found in petroleum. The most effective solvent found for the extraction was benzene or benzene-methanol azeotrope. A method of reciprocal shaking, employing benzene as the solvent was thus determined to be the most efficient extraction of petroleum hydrocarbons from both estuarine and marine sediments. (Prague-FIRL) W75-10241

**PLANNING AND OPERATION OF URBAN WATER QUALITY MANAGEMENT SYSTEMS,**  
Cornell Univ., Ithaca, N.Y.

M. M. El-Sahragy.

Available from the University Microfilms, Inc., Ann Arbor, Michigan, 48106. Order No 74-24,284. Ph.D Thesis, 1974, 176 p.

Descriptors: \*Water pollution control, Computers, \*Systems analysis, \*Model studies, Simulation analysis, Water quality control, Management, Planning, Operations, \*Dynamic programming, \*Linear programming, Municipal water, Mathematical models.

The effectiveness of a systems analysis framework for planning water pollution control systems is investigated. A dynamic programming model was used under deterministic and stochastic conditions; a water quality index was used to obtain optimal operating policy. A metropolitan economic-engineering urban water quality system was defined. Mathematical modeling and programming techniques are used to study interactions between physical, technological, economic, and social aspects of the problems of urban water quality management. A linear programming model was used for the definition of minimum required

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### Water Quality Control—Group 5G

investment in the waste water control system and for the delineation of an optimal allocation of resources within this system. Additionally, computer simulation models are utilized for predicting effectiveness of the water pollution control system. (Prague-FIRL)  
W75-10262

**CHANGING FEDERAL-STATE RELATIONSHIPS IN WATER POLLUTION CONTROL PROGRAMS,**  
Pittsburgh Univ., Pa. Health Law Program.  
J. L. Cohen.  
Industrial Water Engineering, Vol 11, No 4, p 8-11, July/August, 1974.

Descriptors: \*Legislation, \*Water pollution control, \*Pollution abatement, Local governments, Federal government, Federal Water Pollution Control Act, Water permits, Regulation, Water law, Government interrelations, \*Federal-state water rights conflicts.  
Identifiers: \*Federal Water Pollution Control Act Amendments of 1972.

A discussion is presented to show why and how the legal system of the Federal Government answered demands for a more effective water pollution control system and, in the process, how the powers of the Federal Government in this area greatly increased and the states' powers decreased. Areas of interest include: the authority of states to regulate the quality of water within their territorial limits (or their police powers); the right of states to commence an action in Federal District Court to restrain a polluter from contaminating the waters of a state from a point outside its boundaries; the doctrine of federal pre-emption which renders null and void state laws in areas in which Congress has acted (Minnesota was prevented from having more strict laws about nuclear power plants than the AEC allowed); the inconsistencies and confusion that prevailed in the past concerning water pollution control; and the rigorous standards set up by the Federal Water Pollution Control Act Amendments of 1972. The permit system and the issues of the Amendments are discussed. The Amendments basically are a system of regulation that has the Federal Government set the standards for water quality and the state governments are then to supply the manpower to administer and enforce the permit system. The author states that if the governmental officials involved are primarily interested in the control of water pollution, then this new allocation of powers will provide the basis for a more effective and rational water quality control program. However, if the states feel that the system is an infringement of their rights, then the objectives of the legislation will suffer substantially. (Orr-FIRL)  
W75-10270

**REGULATION OF OCEAN DUMPING—ONE YEAR LATER,**  
National Wildlife Federation, Washington, D.C.  
K. S. Kamlet.  
Environmental Law Reporter, Vol IV, p 50021-50022, 1974. 2 p, 5 ref.

Descriptors: \*Legislation, \*Oceans, \*Federal government, \*Waste disposal, Sludge disposal, Radioactive waste disposal, Solid wastes, Water pollution, Waste identification, Environmental effects, Regulation, Administration, Permits, Administrative agencies, Control, Research priorities, Research and development, Marine animals, Marine plants, Protection, Scientific personnel, Bioassay, Legal aspects, Pollutant identification.  
Identifiers: \*Ocean dumping, \*Marine protection, Research and Sanctuaries Act, Public hearings.

Federal agencies and programs involved with regulating and researching ocean dumping are discussed. The Marine Protection, Research, and Sanctuaries Act of 1972 was passed in an effort to 'prevent or strictly limit' the ocean dumping of

harmful materials and to prevent 'unreasonable degradation' of the marine environment. Under the Act certain duties and responsibilities regarding ocean dumping were assigned to the Environmental Protection Agency (EPA), the Army Corps of Engineers, and the National Oceanographic and Atmospheric Administration. The Act places a strict ban on the ocean dumping of certain highly dangerous substances and gives the EPA the power to regulate dumping of other substances by the issuance of permits. The permit system suffers from a lack of funding and manpower and an inability to measure harm done by dumping. The author points out that recently the EPA suspended granting of special three-year, easily renewable permits and is now issuing primarily interim one-year permits which are subject to elaborate scrutiny prior to renewal. (Altuve-Florida)  
W75-10285

**INTERNATIONAL LEGAL IMPLICATIONS OF OFF-SHORE TERMINAL FACILITIES,**  
S. A. Dorshaw.

Texas International Law Journal, Vol 9, p 205-223 (1973). 19 p, 9 ref.

Descriptors: \*International law, \*International waters, \*Oil industry, \*Treaties, Law of the sea, Legal aspects, Jurisdiction, Political aspects, Continental shelf, Oceans, Federal jurisdiction, State jurisdiction, Governments, Governmental interrelations, Judicial decisions, Foreign countries.  
Identifiers: \*Off-shore terminal facilities, Submarine coastal lands, International Court of Justice.

Because of increasing advances in technology, a great concern has arisen over the issues of jurisdiction, sovereignty and control over submarine coastal lands. The author is particularly concerned with international conventions and general principles of international law that pertain to the rights and obligations of nations in the construction and operation of off-shore terminal facilities on the continental shelf and on the high seas. Because this type of facility is relatively new, the legal incidents have not been fully developed. While the 1958 Geneva Conference on the Law of the Sea did not address the problem specifically and in fact concerned itself primarily with issues related to the exploration and exploitation of natural resources, the exercise of jurisdiction by coastal nations over the outer continental shelf and the superadjacent high seas for construction and operation of offshore terminal facilities would probably constitute a reasonable use under the Geneva Convention. The only judicial forum available to test such jurisdictional power is the International Court of Justice at the Hague which has limited powers of enforcement. (Altuve-Florida)  
W75-10286

**OBSTACLES TO TAMING CORPORATE POLLUTERS: WATER POLLUTION POLITICS IN GARY, INDIANA,**  
Hampshire Coll. Amherst, Mass. Dept. of Political Science.

E. Greer.  
Environmental Affairs, Vol 3, p 199-220, (1974). 22 p, 117 ref.

Descriptors: \*Lake Erie, \*Indiana, \*Water pollution, \*Legislation, Legal aspects, Governmental interrelations, Pollution abatement, Water pollution control, Industrial wastes, Water pollution sources, Law enforcement, Water quality, Industrial plants, Cost-benefit analysis, Economic impact, Social impact, Alternative costs, Area redevelopment, Benefits, Employment, Administration, Federal jurisdiction, State jurisdiction, Rivers and Harbors Act.  
Identifiers: \*Water Pollution Control Act, Bureaucracy, Indiana Stream Pollution Control Board.

Although U.S. Steel founded Gary, Indiana, it has failed to use its vast resources to limit harmful pollution and in fact is responsible for the grave pollution problems currently present in Gary and affecting Lake Michigan. The City of Gary has been placed in the precarious position of trying to protect its environmental existence while fearing that pressure on U.S. Steel to clean up its water pollution might cause it to leave Gary and seriously injure the economy. The State of Indiana has a Stream Pollution Control Board, but the Board has lacked the funding and impetus to effectively enforce the State's water pollution regulations. U.S. Steel has been held in violation of several regulations but has been given repeated extensions to remedy the situation. The 1899 Rivers and Harbors Act and the Water Pollution Control Act control the regular discharge of industrial effluents. Because of administrative problems, bureaucratic intricacies, and the complex interaction of the laws, the federal government has failed to substantially affect U.S. Steel's continuing pollution. (Altuve-Florida)  
W75-10287

**APPLICATION OF NEPA TO EPA'S ENVIRONMENTAL REGULATORY ACTIVITIES.**  
Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 6G.  
W75-10288

**SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 6G.  
W75-10289

**PROPOSED 1973 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE- SALE, OFFSHORE MISSISSIPPI, ALABAMA, AND FLORIDA, VOLUME 3, ALTERNATIVES TO THE PROPOSED ACTION (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Bureau of Land Management, Washington, D.C.  
Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-MS-73-1651-F-3. October 17, 1973. 354 p, 3 map 36 tab, 16 fig, 7 graph.

Descriptors: \*Continental shelf, \*Environmental control, Oil, Oil pollution, \*Mississippi, \*Alabama, \*Florida, Environmental effects, Environment, Leases, Offshore platforms, Fuels, Drilling, Alternative planning.  
Identifiers: \*Environmental impact statements.

This environmental impact statement consists of various alternatives to the proposed action. The three main alternatives to the project are to hold the sale in modified form, withdraw the sale, or delay the sale. (Gagliardi-Florida)  
W75-10291

**FEDERAL VIEWPOINT (PERMIT ISSUANCE-ADMINISTRATIVE AND JUDICIAL REVIEW- OBSERVATIONS AND PROBLEMS),**  
Environmental Protection Agency, Chicago, Ill. Enforcement Div.  
W. H. Romanek.  
Natural Resources Lawyer, Vol 7, p 225-230 (1974). 6 p, 2 ref.

Descriptors: \*Federal Water Pollution Control Act, \*Jurisdiction, \*Federal government, \*Permits, \*Legal review, \*Administrative decisions, Legislation, Legal aspects, Administrative agencies, Regulation, Administration, Control, Judicial decisions, Adjudication procedure, Decision making, Management, Planning.  
Identifiers: \*Environmental Protection Agency, National Pollutant Discharge Elimination System, Public hearings, Standing, Administrative remedies.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

The heart of the water quality program under the Federal Water Pollution Control Act is the permit system administered by the National Pollutant Discharge Elimination System (NPDES). The author is concerned with administrative and judicial review of proposed permits or issued NPDES permits. Under administrative review a person may seek a public hearing or an adjudicatory hearing. A public hearing is informally structured and is designed for the collection of facts relating to a permit issuance. Public hearings are held when the Regional administrator finds a significant degree of public interest in a proposed permit. An adjudicatory hearing may follow a public hearing where a permit has been issued or may occur with regard to a proposed permit issuance. Adjudicatory hearings are similar to court proceedings; highly structured and dealing with sharply drawn issues. There is some question of standing to be a party for permit review but the author feels the agency will take a liberal view of standing requirements. The decision of the adjudicatory hearing may be reviewed by the Administrator of the Environmental Protection Agency. After a party has exhausted all of his administrative remedies he may seek judicial review in the Circuit Court of Appeals. (Altuve-Florida)  
W75-10302

**LEGISLATION UNDER NEPA: PLAINTIFFS' PYRRHIC VICTORIES DRAW CONGRESSIONAL FIRE, JUDICIAL WARNINGS,**  
R. P. Higgins.  
Missouri Law Review, Vol 39, p 415-429 (1974). 15 p, 99 ref.

Descriptors: \*Legislation, \*Legal aspects, \*Legal review, \*Judicial decisions, Administrative agencies, Administrative decisions, Environmental effects, Feasibility, Alternative planning, Project planning, Management, Cost-benefit analysis, Political aspects, Political constraints, Federal government, Federal project policy, Public benefits, Federal jurisdiction.  
Identifiers: \*National Environmental Policy Act, \*Environmental impact statement, Disclosure.

As a result of the passage of the National Environmental Policy Act of 1969 (NEPA), the federal courts have become available to environmental plaintiffs as forums for particular grievances and as means of opening the administrative process to citizens. In the early NEPA decisions, the courts focused upon the adequacy of Environmental Impact Statements (EIS) issued by the agencies emphasizing the NEPA requirements for full disclosure of environmental impact and feasible alternatives. More recently the courts have begun to realize that disclosure alone does not guarantee serious consideration of the pros and cons by the agency involved. Thus some courts have read section 101 of NEPA to require review on the merits throughout the process of the project planning, subjecting agency decisions to reversal in the event of a 'clear error of judgement'. In response, a legislative and judicial backlash appears to be building. Courts recently have noted that 'emotional environmentalism must be tempered with rational realism'. (Altuve-Florida)  
W75-10303

**HARDY SALT CO. V. SOUTHERN PACIFIC TRANSPORTATION CO. (SUIT SEEKING INJUNCTIVE RELIEF OR DAMAGES FOR SALINITY CHANGES RESULTING FROM DEFENDANT'S CONSTRUCTION IN THE GREAT SALT LAKE).**  
For primary bibliographic entry see Field 6E.  
W75-10308

**SIERRA CLUB V. LYNN (ACTION FOR DECLARATORY AND INJUNCTIVE RELIEF WITH RESPECT TO DEVELOPMENT OF NEW HOUSING DEVELOPMENT).**  
For primary bibliographic entry see Field 6G.  
W75-10309

**ALABAMA'S WATER RESOURCES POLICY.**  
Alabama Development Office, Montgomery. Available from the National Technical Information Service, Springfield, Va 22161 as PB-234 755. \$3.25 in paper copy, \$2.25 in microfiche. March 1973. 13 p, 1 map, 16 photo.

Descriptors: \*Water policy, \*Water resources, Land resources, \*Alabama, Land, Population, Water conservation, Water demand, Water quality, Water quality control, Water resources development, Water sources, Water supply, Water utilization.  
Identifiers: State policy.

Water resources policy and planning objectives are intimately related to each other and to the public interest. The policy of the State of Alabama is to bring about the systematic development of Alabama's human and natural resources, so that the total water resources of the state will be conserved, developed and used for the maximum benefit of all people of the state. A growing population, an expanding economy, and increasing urbanization make it continually more difficult to properly develop and manage the State's water resources. In future years, the problems of water resources management will become increasingly difficult as new and enlarged uses tax the state's resources. However, it is hoped that adequate and farsighted water resources policies supported by proper planning, implementation and management will enable the state to meet the challenge of providing a total environment of superior quality for all citizens of Alabama. Accomplishment of this objective will require, however, the cooperation of all levels of government, industry, business and the public. (Gagliardi-Florida)  
W75-10310

**REPORT TO THE CONGRESS ON OCEAN DUMPING AND OTHER MAN-INDUCED CHANGES TO OCEAN ECOSYSTEMS (OCTOBER 1972 THROUGH DECEMBER 1973).**  
National Oceanic and Atmospheric Administration, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price \$1.45. March 1974. 96 p, 1 photo, 4 tab, 83 ref, 2 append.

Descriptors: \*Oceans, Water resources, \*Protection, \*Research and development, \*Legislation, Federal government, Water law, Marine fisheries, Resources, Legal aspects, Water pollution, Oil pollution, Dredging, Spoil banks, Fishing, Waste disposal, Mining.  
Identifiers: \*Marine Protection, Research and Sanctuaries Act, \*Hazardous substances(Pollution), Non-point sources(Pollution), National Environmental Policy Act.

Pursuant to the requirements of the Marine Protection, Research and Sanctuaries Act, enacted on October 23, 1972, this first annual report was submitted to Congress by the Department of Commerce. The Act provides for the regulation of ocean dumping, research on ocean dumping and other man-induced changes to ocean ecosystems, and the designation, acquisition, and administration of marine sanctuaries. Section 201 of the Act requires the Secretary of Commerce to maintain a program of monitoring and research regarding the effects of ocean dumping and to report the findings periodically to Congress. The Secretary must include an evaluation of the short-term ecological effects and the social and economic factors involved in ocean dumping, as well as long range effects of pollution on fishing, and man-induced changes of ocean ecosystems. This report presents a perception of the problem of ocean dumping as well as an overview of the more complex, longer-term problems of man's effects on the world's oceans. Included are relevant activities from the enactment of this act through the end of calendar year 1973. (Fernandez-Florida)  
W75-10311

**SMITH V. CITY OF COOKEVILLE (ACTION BY LANDOWNER WHOSE PROPERTY WAS CONDEMNED BY CITY FOR USE IN RECREATION DEVELOPMENT TO ENJOIN CONSTRUCTION UNTIL ENVIRONMENTAL IMPACT STATEMENT IS FILED).**  
For primary bibliographic entry see Field 6E.  
W75-10312

**SCENIC RIVERS ASSOCIATION OF OKLAHOMA V. LYNN (SUIT SEEKING DECLARATORY JUDGMENT THAT HUD MUST MAKE AN ENVIRONMENTAL IMPACT STUDY PRIOR TO THEIR CONTEMPLATED ACTIONS).**  
For primary bibliographic entry see Field 6E.  
W75-10313

**TON-DA-LAY, LTD. V. DIAMOND (REVIEW OF DENIAL OF APPLICATION FOR WATER SUPPLY AND SEWAGE TREATMENT SYSTEMS).**  
For primary bibliographic entry see Field 6E.  
W75-10314

**DUPONT DE NEMOURS AND CO. V. TRAIN (ACTION BY CHEMICAL MANUFACTURERS TO SET ASIDE REGULATIONS GOVERNING EFFLUENT DISCHARGE OF SULFURIC ACID PLANTS).**  
For primary bibliographic entry see Field 6E.  
W75-10316

**OCEAN POLLUTION.**  
Hearings—Subcomm. on Oceans and Atmosphere—Comm. on Commerce, U.S. Senate, 93d Cong, 1st Sess, June 12, 13 and 28, 1973. 393 p, 20 tab, 5 append.

Descriptors: \*Atmosphere, \*Oceans, \*Oil pollution, Metals, Mercury, Wastes, Fallout, Oil, Oil spills, International commissions, Pollutants, Pollution abatement, Pollutant identification, Marine geology, Effluents, Rivers, Air, Air pollution, Air pollution effects, Mining, Energy, Chlorinated hydrocarbon pesticides, Storm water, Environmental effects.

Identifiers: Congressional hearings, International agreements, Oil Pollution Act.

The Senate Subcommittee on Oceans and Atmosphere conducted ocean pollution hearings on June 12, 13 and 28, 1973. Senate Bill 1067 provided for the amending of the Oil Pollution Act, 1961, to implement the 1969 and the 1971 amendments to the International Convention for the Prevention of the Pollution of the Sea by Oil. S. 1070 provided for the implementation of the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969. S. 1351 provided for the amendment to the Marine Protection, Research and Sanctuaries Act of 1972. Among the topics considered by the Subcommittee, were the following: effluent inputs-river and direct coastal discharges; ocean dumping; air pollution; marine mining; energy development; oil; chlorinated hydrocarbons and plastics; toxic metals; mercury distribution; pollutant characteristics; marine pollutants; fallout; oil in stormwaters; organic pollutants; and the scope of marine pollution and the other deterioration of the ocean's environmental quality. Also discussed were the present state of the law of the sea; the necessity for international agreements on standards; the need to ensure that standards are enforceable against foreign flag vessels; and the effects of oil pollution on the marine ecosystem. (Gagliardi-Florida)  
W75-10318

**CHATTahoochee RIVER NATIONAL RECREATION AREA, GEORGIA.**  
For primary bibliographic entry see Field 6G.  
W75-10320

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

#### IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT.

Hearings—Subcomm. on Investigations and Review—Comm. on Public Works, U.S. House of Representatives, 93d Cong., 2d Sess., February 5, 6, 7, April 2, 3, 4, June 25, 26, July 15, 16, 1974. 784 p., multiple photo, fig, tab.

Descriptors: \*Federal Water Pollution Control Act, \*Administration, Water pollution, \*Water pollution control, Water pollution sources, Treatment facilities, Waste treatment, Effluents, Cities, Water Quality Act, Legislation, Legal aspects, Planning, Regulation, Water law, Governmental interrelations, Federal government, Local governments, State governments, Water pollution effects, Control, Water pollution treatment, Water quality, Water quality control.

Identifiers: \*Congressional hearings, \*Federal Water Pollution Control Act Amendments of 1972, Administrative regulations, Effluent limitations, Environmental policy, Hazardous substances(Pollution).

Hearings were held before the House Subcommittee on Investigations and Review for consideration of progress in water pollution control under the Federal Water Pollution Control Act Amendments of 1972. The purpose was to evaluate the program's operation during its earliest months, to facilitate correction of defects either in legislation or in administration, before valuable time is lost and the program is permanently sidetracked. Inquiry was made into major problems in order to assist the Environmental Protection Agency (EPA) by providing more funds, clearing up legislative ambiguities, and reducing redtape. Testimony revealed that the law had been slow in delivering the environmental benefits anticipated. Problems in the distribution of Federal funds to help communities build waste treatment facilities were discussed. State and local officials complained that they were being overwhelmed by ever-changing guidelines and regulations. Effects of the legislation on the electric power generating industry were considered, and various final effluent guidelines, established by the EPA, were discussed. (Fernandez-Florida) W75-10322

#### STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY—PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR INCOMPATIBLE POLLUTANTS.

Environmental Protection Agency, Washington, D.C. Federal Register, Vol 39, No 196, Part IV, p 36210-36211, October 8, 1974. 2 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, \*Water pollution control, Water pollution treatment, \*Effluents, Electric power, Water quality, Water quality control, Water treatment, Federal government, Legislation, Legal aspects, Water Quality Act, Federal Water Pollution Control Act, Water pollution, Water pollution sources, Treatment, Treatment facilities, Thermal power, Hydroelectric plants.

Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, Federal Water Pollution Control Act Amendments of 1972, Hazardous substances(Pollution), National Pollutant Discharge Elimination System.

Notice is given pursuant to the Federal Water Pollution Control Act (FWPCA) as amended, of proposed regulations amending the Steam Electric Power Generating Point Source Category. Guidelines are to be established for each subcategory regarding the extent of application of effluent limitations and guidelines to existing sources which discharge to publicly owned treatment works. The proposed regulation is intended to supplement a final regulation being promulgated simultaneously, by the Environmental Protection

Agency (EPA), which provides effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources within the generating unit, small unit, old unit, and area runoff subcategories. However, the proposed regulation applies to the introduction of incompatible pollutants which are directed into publicly owned treatment works, rather than to discharges of pollutants to navigable waters. Pollutants are divided into two broad categories: compatible and incompatible. Compatible pollutants are generally not subject to pretreatment standards. It is the incompatible pollutants which are the subject of the proposed regulation. (Fernandez-Florida) W75-10323

#### MARINE SANITATION DEVICES—PROPOSED CERTIFICATION PROCEDURES AND DESIGN AND CONSTRUCTION REQUIREMENTS.

Coast Guard, Washington, D.C. Federal Register, Vol 39, No 42, Part II, p 8038-8044, March 1, 1974. 7 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Coast guard regulations, \*Environmental sanitation, \*Water pollution control, \*Regulation, Control, Water quality, Water quality control, Water pollution sources, Federal government, Legal aspects, Sanitary engineering, Disposal, Sewage, Waste water(Pollution), Waste disposal, Environmental engineering, Sewage treatment, Waste water treatment, Water pollution, Waste treatment, Oceans. Identifiers: Administrative regulations, Certification, \*Federal Water Pollution Control Act Amendments of 1972, Coastal waters, Effluent limitations, Environmental policy, Hazardous substances(Pollution), National Pollutant Discharge Elimination System, Territorial waters.

This notice proposes Coast Guard regulations governing the design, construction, testing, certification, and manufacture of marine sanitation devices. In order to eliminate the discharging of untreated sewage from vessels into the waters of the United States, including territorial seas, subpart A prescribes regulations governing the design and construction of marine sanitation devices and procedures for certifying that marine sanitation devices meet the regulations and the standards of the Environmental Protection Agency (EPA), promulgated under the Federal Water Pollution Control Act. Further included are regulations governing the manufacture and operation of vessels equipped with marine sanitation devices. Subpart B prescribes procedures for certification of marine sanitation devices and recognition of facilities for the purpose of conducting tests and evaluations of marine sanitation devices. The final subpart provides specifications governing the design and construction of specified marine sanitation devices, and requires all devices, for which certification is requested, to meet the enumerated standards. Legal authority for these rules is found in the Federal Water Pollution Control Act. (Fernandez-Florida) W75-10324

#### CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, D.C. Federal Register, Vol 39, No 56, Part III, p 10862-10870, March 21, 1974. 9 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, \*Water pollution control, Water pollution treatment, \*Effluents, Water quality, Water quality control, Water treatment, Federal government, Legislation, Legal aspects, Water Quality Act, Water pollution, Federal Water Pollution Control Act, Water pollution sources, Treatment, Treatment

facilities, Vegetable crops, Potatoes, Fruit crops, Canners.

Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, Federal Water Pollution Control Act Amendments of 1972, Hazardous substances(Pollution), National Pollutant Discharge Elimination System.

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the Canned and Preserved Fruits and Vegetables Processing category of point sources, by amending 40 CFR Chapter 1, Subchapter N to add a new part 407. This final rulemaking is promulgated by the Environmental Protection Agency (EPA) pursuant to the Federal Water Pollution Control Act. Guidelines are established for the following subcategories: apple juice, apple products, citrus products, frozen potato products and dehydrated potato products. In addition, EPA is simultaneously proposing a separate provision stating the application of the limitations and standards to users of publicly owned treatment works which are subject to pretreatment standards. Notice is given of proposed regulations concerning the application of effluent limitations guidelines for existing sources to pretreatment standards for incompatible pollutants. (Fernandez-Florida) W75-10325

#### LIQUID AND CRYSTALLINE CANE SUGAR REFINING SUBCATEGORY—EFFLUENT LIMITATIONS GUIDELINES AND PROPOSED PRETREATMENT STANDARDS.

Environmental Protection Agency, Washington, D.C. Federal Register, Vol 39, No 55, Part III, p 10522-10528, March 20, 1974. 7 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, \*Effluents, \*Sugarcane, \*Food processing industry, Pollutants, Industries, Navigable waters, Wastes, Industrial plants, Discharge(Water), Industrial waters, Water pollution sources, Environmental effects, Pollution abatement, Federal government, Standards, Water pollution, Waste water treatment, Water treatment, Treatment, Treatment facilities.

Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, FWPCA Amendments of 1972, Hazardous substances(Pollution), National Pollutant Discharge Elimination System.

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the sugar processing category of point sources, by amending 40 CFR Chapter 1, Subchapter N, Part 409. Guidelines are established for the crystalline cane sugar and liquid cane sugar categories. The limitations govern the quantity and quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of this regulations after application of the best available technology economically achievable. Additionally, the Environmental Protection Agency simultaneously proposes rules stating the application of the limitations and standards to users of publicly owned treatment works which are subject to pretreatment standards. Notice is given of proposed regulations concerning the application of effluent limitations guidelines for existing sources to pretreatment standards for incompatible pollutants. (Fernandez-Florida) W75-10326

#### INORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Federal Register, Vol 39, No 49, Part II, p 9612-9639, March 12, 1974. 28 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, \*Chemical wastes, \*Inorganic compounds, \*Effluents, Chemical industry, Industries, Discharge(Water), Industrial wastes, Water pollution sources, Environmental effects, Pollution abatement, Federal government, Standards, Water pollution, Chemicals, Recycling, Waste water treatment, Waste treatment, Water reuse, Treatment, Treatment facilities, Flocculation.

Identifiers: \*Administrative regulations, \*Effluent limitations, \*Pretreatment standards, Environmental policy, FWPCA Amendments of 1972, Hazardous substances(Pollution).

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the inorganic chemicals manufacturing category of point sources, by amending 40 CFR Chapter 1, Subchapter N, to add a new part 415. Twenty-two subcategories have been established based on the chemical product manufactured. Where total recycle, sale, recovery, or reuse of process waste water is technically and economically feasible, the discharge of all process waste water pollutants is limited. Discharge of pollutants to municipal treatment systems is allowed in limited quantities necessary to ensure adequate treatment and to prevent interference with the performance of the system. The effluent limitations in this regulation generally will be applied as absolute discharge limitations. Treatment alternatives include sedimentation basins, flocculators, and clarifiers. For chemical subcategories which disallow discharge of process waste water pollutants to navigable waters and for which ponds may be part of the treatment system, an allowance is provided to permit a discharge of process waste water from a plant located in an area where rainfall exceeds the evaporation rate or in the event of a catastrophic rainfall. (Fernandez-Florida)

W75-10327

#### ELECTROPLATING POINT SOURCE CATEGORY; COPPER, NICKEL, CHROMIUM AND ZINC ON FERROUS AND NONFERROUS MATERIALS SUBCATEGORY.

Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 39, No 61, Part II, p 11510-11516, March 28, 1974. 7 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, \*Effluents, \*Inorganic compounds, \*Iron alloys, Copper, Metals, Chromium, Zinc, Hydrogen ion concentration, Discharge(Water), Industrial wastes, Water pollution sources, Environmental effects, Pollution abatement, Federal government, Standards, Water pollution, Waste water treatment, Waste treatment, Treatment facilities.

Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, FWPCA Amendments of 1972, Hazardous substances(Pollution), National Pollutant Discharge Elimination System.

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the electroplating category of point sources by amending 40 CFR Chapter 1, Subchapter N, to add a new Part 413. Subcategories governed by the regulation include: electroplating of copper, nickel, chromium, and zinc on ferrous and nonferrous materials. The provisions of this regulation are applicable to discharges of pollutants resulting from the process in which a ferrous or nonferrous base material is rack or barrel electroplated with copper, nickel, chromium, zinc, or any combination thereof. The

best practicable control technology currently available consists of cyanide destruction, equalization, and pH adjustment. In addition, the Environmental Protection Agency is simultaneously proposing a separate provision stating the application of the limitations and standards to users of publicly owned treatment works which are subject to pretreatment standards, as well as application to pretreatment standards for incompatible pollutants. (Fernandez-Florida)

W75-10328

#### THERMAL DISCHARGES—PROPOSED PROCEDURES FOR THE IMPOSITION OF ALTERNATIVE EFFLUENT LIMITATIONS.

Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 39, No 61, p 11434-11441, March 28, 1974. 8 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Permits, \*Regulation, \*Discharge(Water), \*Thermal pollution, Legal aspects, Fish, Aquatic life, Wildlife, Biota, Bodies of water, Thermal water, Environmental effects, Effluents, Pollution abatement, Temperature, Water cooling, Water temperature, Federal government, Standards, Water pollution, Heated water, Federal Water Pollution Control Act.

Identifiers: Administrative regulations, Effluent limitations, \*National Pollutant Discharge Elimination System, \*Pretreatment standards(Effluent), Environmental policy, FWPCA Amendments of 1972, Hazardous substances(Pollution).

The proposed regulations establish procedures for the imposition of alternative effluent limitations on the thermal component of discharges, authorized by section 316(a) of the Federal Water Pollution Control Act, as amended. Alternative effluent limitations may be imposed by the Environmental Protection Agency Administrator, if the owner or operator of a point source has demonstrated to the satisfaction of the administrator that proposed effluent limitations are more stringent than necessary to assure the protection and propagation of a balanced indigenous population of shellfish and fish and wildlife. Granting of National Pollutant Discharge Elimination System permits is made contingent upon a showing by the applicant of absence of prior harm, in the case of a point source which has commenced operation and discharge, and a demonstration that representative, important species will be adequately protected. Evidence may be produced in the forms of historical biological data, physical monitoring data, engineering or diffusion models, or any other relevant information. (Fernandez-Florida)

W75-10329

#### ASBESTOS MANUFACTURING POINT SOURCE CATEGORY—EFFLUENT LIMITATIONS GUIDELINES.

Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 39, No 39, Part II, p 7526-7535, February 26, 1974. 10 p.

Descriptors: \*Water quality standards, \*Administrative agencies, \*Regulation, Standards, \*Effluents, \*Asbestos, Silicates, Asbestos cement, Calcium compounds, Inorganic compounds, Federal government, Legal aspects, Control, Wastes, Industrial wastes, Environmental effects, Environmental control, Pollutants, Pollution abatement, Treatment, Waste treatment, Industrial plants, Specifications.

Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, Hazardous substances(Pollution).

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment

standards for new sources in the asbestos manufacturing category of point sources by amending 40 CFR Chapter 1, Subchapter N, to add a new Part 427. Subcategories regulated included: asbestos-cement pipe, asbestos-cement sheet, asbestos paper (starch binder), asbestos paper (elastomeric binder), asbestos millboard, asbestos roofing products, and asbestos floor tile. Each subpart delineates its applicability, specialized definitions, standards of performance and pretreatment standards for new sources, and effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology economically achievable and currently available. Additionally, the Environmental Protection Agency proposes provision stating the application of the limitations and standards to users of publicly owned treatment works which are subject to pretreatment standards. (Fernandez-Florida)

W75-10330

#### FERROALLOY MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 39, No 37, Part II, p 6806-6814, February 22, 1974. 9 p.

Descriptors: \*Water quality standards, \*Regulation, \*Administrative agencies, Standards, \*Effluents, \*Iron alloys, Legal aspects, Control, Federal government, Wastes, Industrial wastes, Environmental effects, Environmental control, Alloys, Pollutants, Pollution abatement, Treatment, Waste treatment, Industrial plants, Specifications, Air pollution.

Identifiers: Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, Hazardous substances(Pollution).

The purpose of this notice is to establish final effluent limitations guidelines by the Environmental Protection Agency (EPA) for existing sources and standards of performance and pretreatment standards for new sources in the ferroalloy manufacturing category of point sources, by amending 40 CFR Chapter 1, Subchapter N, to add a new Part 424. In addition, the EPA simultaneously proposes a separate provision stating the application of the limitations and standards to users of publicly owned treatment works which are subject to pretreatment standards. Subpart A of the regulation covers open electric furnaces with wet air pollution control devices, and delineates effluent limitation guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available as well as economically achievable. This part also sets standards of performance and pretreatment standards for new sources. Subpart B regulates covered electric furnaces and other smelting operations with wet air pollution control devices, and subpart C sets guidelines for slag processing. (Fernandez-Florida)

W75-10332

#### FEEDLOTS POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 39, No 32, Part II, p 5704-5710, February 14, 1974. 7 p.

Descriptors: \*Water quality standards, \*Standards, \*Regulation, \*Effluents, \*Waste treatment, \*Feed lots, Administrative agencies, Legal aspects, Administration, Wastes, Water pollution sources, Discharge(Water), Waste water(Pollution), Water pollution, Treatment, Waste water treatment, Cleaning, Water pollution treatment, Disposal, Sanitary engineering, Treatment facilities, Industrial wastes, Navigable waters, Confined pens, Farm wastes, Ruminants.

## WATER RESOURCES PLANNING—Field 6

### Techniques Of Planning—Group 6A

**Identifiers:** Administrative regulations, Effluent limitations, \*FWPCA Amendments of 1972, Pretreatment standards(Effluent), Environmental policy, Hazardous substances(Pollution).

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the feedlots category of point sources, by amending 40 CFR Chapter 1, Subchapter N, to add part 412. This regulation applies to Subpart A—Subcategories Except Ducks, as well as to Subpart B—Ducks Subcategory. 'Feedlot' is defined as a concentrated, confined animal or poultry growing operation for meat, milk, or egg production. Discharge of process waste water pollutants to navigable waters is prohibited except when chronic rainfall causes an overflow of process waste water from a containing facility. Additionally, the Environmental Protection Agency simultaneously proposes rules stating the application of the limitations and standards to users of publicly owned treatment standards. Further, notice is hereby given, pursuant to the Federal Water Pollution Control Act, as amended, of proposed regulations concerning the application of effluent limitations guidelines for existing sources to pretreatment standards for incompatible pollutants. (Fernandez-Florida)  
W75-10333

#### GLASS MANUFACTURING POINT SOURCE CATEGORIES—EFFLUENT GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol 39, No 32, Part 111, p 5712-5721, February 14, 1974. 10 p.

**Descriptors:** \*Water quality standards, \*Administrative agencies, Standards, \*Regulation, \*Effluents, \*Waste treatment, Legal aspects, Administration, Wastes, Water pollution sources, Discharge(Water), Waste water(Pollution), Water pollution treatment, Waste water treatment, Cleaning, Disposal, Sanitary engineering, Treatment facilities, Industrial wastes.

**Identifiers:** Administrative regulations, Effluent limitations, \*FWPCA Amendments of 1972, Glass manufacturing, Environmental policy, Hazardous substances(Pollution), Pretreatment standards(Effluent).

The purpose of this notice is to establish final effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources in the glass manufacturing category of point sources by amending 40 CFR Chapter 1, Subchapter N, Part 426. Guidelines are established for the following subcategories of manufacturing: sheet glass, rolled glass, plate glass, float glass, automotive glass tempering, and automotive glass laminating. The various subcategories are individually described. Effluent limitations guidelines are delineated in terms representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available and the best available technology economically achievable. In addition, the Environmental Protection Agency simultaneously proposes a separate provision concerning the application of the limitations and standards to users of publicly owned treatment works which are subject to pretreatment standards. Further, notice is given of proposed regulations concerning the application of effluent limitations guidelines for existing sources to pretreatment standards for incompatible pollutants. (Fernandez-Florida)  
W75-10334

#### THERMAL DISCHARGES.

Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol 39, No 196, Part 11, p 36178-36184, October 8, 1974. 7 p.

**Descriptors:** \*Water quality standards, \*Administrative agencies, \*Permits, \*Regulation, \*Discharge(Water), Thermal pollution, Legal aspects, Fish, Aquatic life, Wildlife, Biota, Bodies of water, Thermal water, Environmental effects, Effluents, Pollution abatement, Temperature, Water cooling, Water temperature, Federal government, Standards, Water pollution, Heated water.

**Identifiers:** Administrative regulations, Effluent limitations, \*National Pollutant Discharge Elimination System, Pretreatment standards(Effluent), Environmental policy, FWPCA Amendments of 1972, Hazardous substances(Pollution).

These regulations describe procedures for the imposition of alternative effluent limitations, with respect to the thermal component of discharges, authorized by section 316(a) of the Federal Water Pollution Control Act, as amended. The Administrator of the Environmental Protection Agency is responsible for determining that effluent limitations on the thermal component of proposed discharges are 'more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the body of water into which the discharge is to be made'. The regulations require public notice of each proposed issuance, denial, or modification of a permit. An applicant may satisfy the burden of proof that aquatic biota will be adequately protected by showing an absence of prior appreciable harm, and provision for protection of representative important species through production of biological, engineering, and other data. Substantial, irreversible environmental modifications must be taken into consideration in identifying the balanced indigenous communities. (Fernandez-Florida)  
W75-10335

#### BUILDERS PAPER AND BOARD MANUFACTURING POINT SOURCE CATEGORY—EFFLUENT LIMITATIONS GUIDELINES.

Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol 39, No 9, Part 11, p 1818-1821, January 14, 1974. 4 p.

**Descriptors:** \*Water quality standards, \*Administrative agencies, \*Regulation, \*Water pollution control, \*Water pollution treatment, \*Effluents, Water quality, Water quality control, Water treatment, Federal government, Legislation, Legal aspects, Water Quality Act, Water pollution, Federal Water Pollution Control Act, Water pollution sources, Treatment, Treatment facilities, Pulp and paper industry, Pulp wastes, Wood wastes.

**Identifiers:** Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, Federal Water Pollution Control Act Amendments of 1972, Hazardous substances(Pollution), National Pollutant Discharge Elimination System.

Notice is given of proposed effluent limitations guidelines for existing sources and standards of performance and pretreatment standards for new sources for the builders paper and roofing felt subcategory of the builders paper and board manufacturing category of point sources. Legal authority for promulgation of these rules by the Environmental Protection Agency (EPA) is found in the Federal Water Pollution Control Act. The instant subcategory includes mills which produce the heavy papers used in the construction industry from cellulose fibers derived from waste paper, wood flour and sawdust, wood chips, and rags, without bleaching or chemical pulping. Builders papers are generally characterized as saturating papers, flooring paper, and deadening papers which are used in the construction and automotive industries. Significant pollutant parameters in waste waters include five day biochemical oxygen demand, total suspended non-filterable solids, and

pH. Effluent limitations guidelines and standards of performance are established to control these pollutants. Treatment and control technology includes water re-use and recirculation, preliminary screening, primary sedimentation, biological treatment, and physical chemical treatment. (Fernandez-Florida)  
W75-10336

**STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol 39, No 196, Part 111, p 36186-36207, October 8, 1974. 22 p.

**Descriptors:** \*Water quality standards, \*Administrative agencies, \*Regulation, \*Effluents, \*Steam, \*Electric power, Thermal power, Thermal powerplants, Waste treatment, Treatment, Treatment facilities, Pollutants, Industries, Navigable waters, Wastes, Industrial plants, Discharge(Water), Industrial wastes, Water pollution sources, Environmental effects, Pollution abatement, Federal government, Standards, Water pollution, Waste water treatment.

**Identifiers:** Administrative regulations, Effluent limitations, Pretreatment standards(Effluent), Environmental policy, FWPCA Amendments of 1972, Hazardous substances(Pollution), National Pollutant Discharge Elimination System.

The purpose of this notice is to establish final effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources in the steam electric power generating category by amending 40 CFR Chapter 1, Subchapter N to add a new part 423. Subcategories regulated include: generating unit, small unit, old unit, and area runoff. With respect to the first three subcategories, this regulation applies to discharges resulting from the operation of a generating unit by an establishment primarily engaged in the generation of electricity for distribution and sale which principally results from a process utilizing fossil-type fuel or nuclear fuel in conjunction with a thermal cycle employing the steam-water system as the thermodynamic medium. Limitations are established regarding the quantity and quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of this regulation. The pH of all discharges, as well as polychlorinated biphenol compounds, and low volume waste sources are limited through the application of a flow rate formula. (Fernandez-Florida)  
W75-10337

**PAMLICO RIVER ESTUARY—PAST, PRESENT AND FUTURE,**  
North Carolina State Univ., Raleigh. Dept. of Zoology.  
For primary bibliographic entry see Field 2L.  
W75-10338

**TENTH ANNUAL REPORT, FISCAL YEAR 1974,**  
Auburn Univ., Ala. Water Resources Research Inst.  
For primary bibliographic entry see Field 9D.  
W75-10339

## 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

**PROJECT EVALUATION IN WATER RESOURCES: BUDGET CONSTRAINTS,**  
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

## Field 6—WATER RESOURCES PLANNING

### Group 6A—Techniques Of Planning

D. C. Major, J. Cohon, and E. Frydl.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 567, \$9.25 in paper copy, \$2.25 in microfiche. Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Technical Report 188, September 1974. 284 p. 45 fig. 31 tab, 39 ref. 3 append. OWRT C-3370 (no. 3720)(1). 14-31-0001-3720.

Descriptors: \*Project planning, \*Budgeting, \*Linear programming, \*Delaware River, \*Cost-benefit analysis, Federal budget, Non-reimbursable costs, Welfare(Economics), Economics, \*Evaluation, Income analysis, Regional analysis, Floods, Powerplants, Water supply, \*Pennsylvania, Investment, Income distribution, \*Computer models.

Identifiers: \*Multiobjectives, \*Budget constraints, \*Investment criteria, \*Lehigh River(Penn), Income distribution, Regional income.

A multiobjective mathematical programming model was developed for the Lehigh River, Pennsylvania, in locally and globally optimal versions. Objectives for the Lehigh representing each of the four accounts of the Water Resources Council's proposed 1970 standards are discussed and the models are formulated for three of these: increasing national income, regional and class income distribution, and environmental quality. The design variables in the model are the reservoirs and power plants considered in the Corps of Engineers' 1961 report on the Delaware river basin, which includes the Lehigh. Runs of the models were made for one, two and three objectives, constrained by total and local budgets of varying size. Results from the globally optimal model are presented. These show the estimated effects on multidimensional net benefit surfaces and on the design variables of the budget constraints. There is a general discussion of the nature and use of budget constraints in multiobjective planning, and suggestions are made for implementing the work at the district (Corps) or region (Bureau of Reclamation) levels.

W75-09851

APPLICATIONS OF INTEGER AND QUADRATIC PROGRAMMING TO FLOOD-PLAIN LAND USE MANAGEMENT, Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.

For primary bibliographic entry see Field 6F.

W75-10008

A COMPUTER SIMULATION ANALYSIS OF SURFACE WATER QUALITY MANAGEMENT POLICIES UNDER DYNAMIC ECONOMIC AND HYDROLOGIC CONDITIONS, Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.

For primary bibliographic entry see Field 5D.

W75-10124

RESERVOIR RELEASE ROUTING MODEL FOR THE UPPER ARKANSAS RIVER BASIN OF COLORADO, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 4A.

W75-10165

TOTAL APPROACH FOR THE BOGOTA, COLUMBIA, WATER SUPPLY, Empresa de Aqueuducto y Alcantarrillado, Bogota (Colombia).

For primary bibliographic entry see Field 3D.

W75-10203

EFFECT OF WIND WAVES AND WIND TIDES ON THE OPTIMUM CONTROL OF LARGE LAKES, Arizona Univ., Tucson. Bureau of Business Research.

For primary bibliographic entry see Field 4A.

W75-10204

OPTIMAL CONTROL OF WATER POLLUTION IN A RIVER STREAM, Alberta Univ., Edmonton. Dept. of Electrical Engineering.

For primary bibliographic entry see Field 5G.

W75-10206

DETERMINISTIC MODEL OF DYNAMIC EUTROPHIC ESTUARY, Air Products and Chemicals, Inc., Allentown, Pa.

For primary bibliographic entry see Field 5B.

W75-10215

A SENSITIVITY ANALYSIS OF SIMULATED RIVER BASIN PLANNING FOR CAPITAL BUDGETING DECISIONS, Idaho State Univ., Pocatello. Coll. of Business.

G. R. Wells.

Computers and Operations Research, Vol 2, No 1, p 49-54, April 1975. 4 fig, 1 tab, 12 ref.

Descriptors: \*River basin development, \*Multiple-purpose projects, \*Simulation analysis, \*Computer models, \*Alternative planning, Capital Budgeting, Decision making, Assessment, Reservoirs, \*Oregon, Cost-benefit ratio, Operation and maintenance, Design, Probability, Dams, Size, Investment, Hydrologic data, Systems analysis.

Identifiers: \*Sensitivity analysis, \*Grande Ronde Basin(Ore), Operating procedures, Water uses, Water flows, Changes, Exogenous variables, Endogenous variables.

Application of a computer simulation model to the Grande Ronde River basin in northeastern Oregon is described. The model considers the effects of changes in sets of capital and in operating procedures on project benefits and costs. The methodology employed is probabilistic, utilizing hydrologic data for simulation of water flows and probability distributions for amounts of capital investment and annual operation and maintenance costs. Exogenous variables include: hydrologic data based on 41 years of historical data; capital sets for three different sizes of two reservoirs; and operating procedures for three scales of irrigation development. The functional relationships for benefits entail relationships between hydrologic phenomena and benefits for seven uses of water: irrigation; municipal and industrial water supply; recreation; salmon reared in reservoir; resident trout in reservoir; flood control; and anadromous fish. The endogenous variables resulting from running the model include net present benefits and benefit-cost ratios for nine reservoir combinations and three operating procedures (a decision set of 27). Results indicate that some decision sets are clearly superior to others and reduce the choice set from 27 to three. The simulation model provides a framework for the analysis of dam sizes for river basin planning. (See also W75-02615) (Bell-Cornell)

W75-10223

RIVER POLLUTION CONTROL, Saint John's Coll., Cambridge (England).

M. G. Singh.

International Journal of Systems Science, Vol 6, No 1, January 1975. p 9-21, 5 fig, 6 equ, 10 ref.

Descriptors: \*Water pollution control, \*Rivers, \*Simulation analysis, Digital computers, Optimization, Estimating, Reach(Streams), Biochemical oxygen demand, Dissolved oxygen, Equations, Mathematical models, Systems analysis.

Identifiers: \*Cam River(Cambridge Engl), Automatic control systems, Cost function, Mass balance.

A preliminary study is made of the dynamic optimization problem for a river with many polluters using a recently developed model of a section of the river Cam near Cambridge, England. Due to the high dimensionality of the system, it is computationally prohibitive to obtain optimal solutions. But the system has a fairly simple structure which could be utilized to alleviate the computational burden. A simple hierarchical structure is proposed for the river pollution control and the strategy is demonstrated on a digital simulation. For the practical implementation of the strategy, it is necessary, however, to have available the state vector of the system. In practice, only certain corrupted measurements of the outputs are available. It is therefore necessary to construct a state estimator. Like the optimal controller, the optimal estimator also requires prohibitive amounts of computation. However, a hierarchical strategy similar to the control strategy could be used to alleviate the computational burden. Such an estimator is also demonstrated on a digital simulation of the river. The simple approach to control and state estimation described here appears to be promising since it is able to provide virtually optimal performance and has modest enough computational requirements to enable it to be implemented on a single small computer. (Bell-Cornell)

W75-10224

PROPOSED 1973 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE- SALE, OFFSHORE MISSISSIPPI, ALABAMA, AND FLORIDA, VOLUME 3, ALTERNATIVES TO THE PROPOSED ACTION (FINAL ENVIRONMENTAL IMPACT STATEMENT), Bureau of Land Management, Washington, D.C.

For primary bibliographic entry see Field 5G.

W75-10291

PLAN FORMULATION AND EVALUATION STUDIES—RECREATION, VOL 1 OF V. EVALUATION OF RECREATION USE SURVEYS PROCEDURES, Army Engineer District, Sacramento, Calif.

For primary bibliographic entry see Field 6B.

W75-10342

PLAN FORMULATION AND EVALUATION STUDIES—RECREATION, VOL. III OF V. A PRELIMINARY ANALYSIS OF DAY USE RECREATION AND BENEFIT ESTIMATION MODELS FOR SELECTED RESERVOIRS, Army Engineer District, Sacramento, Calif. For primary bibliographic entry see Field 6B.

W75-10343

PLAN FORMULATION AND EVALUATION STUDIES—RECREATION, VOL. V OF V. A GENERALIZED RECREATION DAY USE PLANNING MODEL, Army Engineer District, Sacramento, Calif. For primary bibliographic entry see Field 6B.

W75-10345

### 6B. Evaluation Process

PROJECT EVALUATION IN WATER RESOURCES: BUDGET CONSTRAINTS, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

For primary bibliographic entry see Field 6A.

W75-09851

SOCIOLOGICAL IMPACT OF A FLOOD CONTROL RESERVOIR, HOWARD, PENNSYLVANIA, Pennsylvania State Univ., Inst. for Research on Land and Water Resources. University Park.

S. M. Leadley.

## WATER RESOURCES PLANNING—Field 6

### Evaluation Process—Group 6B

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 577, \$3.75 in paper copy, \$2.25 in microfiche. Completion Report, July 1975. 44 p, 2 tab, 3 append, 1 fig, 15 ref. OWRT A-017-PA(3), 14-31-0001-3238.

Descriptors: \*Social change, \*Reservoir construction, \*Recreational facilities, \*Social impact, Social aspects, Psychological aspects, \*Pennsylvania, Retention, Flood control, Reservoirs, Pre-impoundment.

Identifiers: \*Neighborhood awareness, Perceptual error, Perception, Families displaced, Jobs eliminated, Community leaders, Family resilience, Howard(Penn).

The original assumption that individuals are capable of accurately reporting the magnitude of social changes was unjustified as was noted in the data. A specific analysis of a number of variables relating to the variations in perceptual error revealed that no one single factor could be used as a reliable predictor of these errors. Other social and psychological variables might be selected to better represent the selective processes of exposure, perception and retention. For example, rather than obtaining estimates from respondents regarding families displaced or jobs eliminated by reservoir construction for the entire reservoir area, it may be necessary to use respondent-defined neighborhood areas within which the estimates are obtained. For applied research, it is clear from the magnitude of error that the average citizens and also the community leaders fail to comprehend the magnitude of changes in which they have been caught up. This lack of awareness and understanding appears to be one factor related to the depression of apparent organizational response to changes in the physical and social environments. (Sink-Penn State)

W75-0984

**GEORGIA COUNTY COMMISSIONER ATTITUDES TOWARD WATER PROBLEMS,**  
Georgia Univ., Athens. Dept. of Political Science.  
For primary bibliographic entry see Field 6E.  
W75-0985

**THE ECONOMIC IMPACT OF A SMALL RECREATION-ORIENTED RESERVOIR,**  
University of Southern Mississippi, Hattiesburg.  
Bureau of Business Research.

D. L. Daniel, and D. C. Williams, Jr.  
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 559, \$3.75 in paper copy, \$2.25 in microfiche. Mississippi Water Resources Research Institute, Mississippi State, Completion Report, July 1975. 30 p, 8 tab, 14 ref. OWRT A-080-MISS(1).

Descriptors: Economics, \*Recreation, Reservoirs, \*Economic impact, Model studies, \*Mississippi, \*Evaluation, \*Income analysis, Costs, County governments, Wages, Taxes, Salaries.  
Identifiers: \*Flint Creek Reservoir(Miss).

This project sets up an economic model that is readily applicable to evaluating the economic effects of small recreation-oriented reservoirs upon the local economies of the area in which the reservoir is located. The economic effect was measured in terms of personal income. The approach used was to determine the amount of basic income created by the reservoir, and then multiply that by the area's basic income multiplier. The model was applied to Flint Creek Reservoir in Stone County, Mississippi. During a 12 month study period, the reservoir attracted 104,336 visitors; most of them were nonlocal. Expenditures by nonlocal visitors were converted into basic income created in the local area. Each camping visitor resulted in approximately \$1.75 of additional basic income in the area or a total \$31,300 in new basic income. Day visitors added \$1,300 to the total. Expenditures by the operator, the Pat Harrison Waterway District, for wages and salaries to local area residents

represented an additional \$82,400 in basic income. The basic income multiplier for Stone County is approximately 1.64. All basic income attributable to the reservoir was multiplied by this factor to obtain an estimate of the total effect of the reservoir on personal income in Stone County of \$188,600. In addition, the reservoir generates approximately \$15,900 annually of new sales taxes of which almost \$13,500 is given to the county.  
W75-09857

**FEASIBILITY AND POTENTIAL OF ENHANCING WATER RECREATION OPPORTUNITIES ON HIGH COUNTRY RESERVOIRS-PHASE I,**  
Colorado State Univ., Fort Collins. Dept. of Recreation Resources.  
R. Aukerman.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 564, \$7.00 in paper copy, \$2.25 in microfiche. Colorado, Environmental Resources Center, Fort Collins, Completion Report Series, No. 62, June 1975. 185 p, 19 fig, 51 tab, 43 ref, 2 append. OWRT B-104-COLO (2). 14-31-0001-4066.

Descriptors: \*Feasibility studies, \*Recreation, \*Water sports, Reservoirs, Management, Reservoir storage, Recreation facilities, \*Recreation demand, Fishing, \*Sport fishing.

Identifiers: \*High country reservoirs, \*Water-based recreation.

High country water storage reservoirs were studied for the purpose of developing a user profile which could be used to predict recreation users desires. Findings identify several sub-groups of the recreation user public at high-country reservoirs. Management information has been gathered, which will be helpful in making decisions on what facilities to provide, where to provide them, which reservoirs to open for various users, what use might be expected, what type of access is needed, what users will pay for the experience, and what type of fishery is needed. A surprising finding from the fisherman profile indicates that most fishermen do not care if they catch a single fish, but are more interested in other qualities of the experience. (Evans-Colorado)  
W75-09894

**METHODS TO FACILITATE MANAGERIAL EFFECTIVENESS IN MUNICIPAL WATER SYSTEMS,**  
Mississippi State Univ., Mississippi State. Bureau of Business and Economic Research.

K. W. Hollman, R. F. Bush, J. F. Hair, Jr., E. E. Milam, and J. H. Sellers.  
Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 565, \$4.25 in paper copy, \$2.25 in microfiche. Completion Report, Mississippi Water Resources Research Institute, Mississippi State, July 1975. 59 p, 14 tab. OWRT B-010-MISS(1).

Descriptors: \*Cost analysis, \*Management, Water supply, \*Mississippi, \*Municipal water, \*Model studies, \*Water management(Applied), Utilities, \*Cost comparisons, Cost trends.  
Identifiers: Multiple discriminant analysis, Multiple factor analysis.

The project focused on the quality of municipal water system management in Mississippi. The primary objectives were to determine what factors play a part in achieving greater efficiency in water system management and to what extent. An analytic model using multiple discriminant analysis and multiple factor analysis was formulated. A subset of 45 municipal water systems in Mississippi was used for the data base. Initially, twenty-two variables classified by degree of controllability and by major cost category were selected, but the model was later reduced to 12 variables. The systems were divided into three groups of 15 each on the basis of efficiency. Then the multivariate

techniques were used to identify the significant cost variables within each general cost category at each efficiency level, and a relative numeric measure of the importance of each cost factor in each of the three levels of performance was computed. The study shows that a model with only a small number of variables, but with a high predictive accuracy, can be developed to assign water utilities to appropriate efficiency level groups. Information generated by the model will help municipal water managers to determine the amount of change in each of a few significant cost variables that is necessary for their system to reach a prespecified cost improvement goal.  
W75-09895

**WATER RESOURCES DEVELOPMENT AND WILDERNESS VALUES: A STUDY OF THE UPPER HUDSON RIVER,**  
Cornell Univ., Ithaca, N.Y., Water Resources and Marine Sciences Center.  
G. R. Reetz.

Available from the National Technical Information Service as PB-243 736, \$5.75 in paper copy, \$2.25 in microfiche. Completion Report, 140 p, 26 tab, 11 fig, 151 ref, 2 append. OWRT A-043-NY(1). 14-31-0001-3832, 4032.

Descriptors: \*Water resources development, \*Decision making, Reservoir sites, \*Hudson River, \*Planning, Preservation, Environmental effects, \*New York, Values, \*Evaluation, Aesthetic, Water values, Social values.  
Identifiers: Gooley Reservoir(NY), \*Wilderness values, Preservation organizations.

Conflicts between water resources development proposals and desires to preserve natural environments have occurred in many areas of the United States, the debates often reaching the highest levels of government. Growing demands for both water and wilderness suggest a potential for increased competition in the future. The controversy over the proposed Gooley Dam, on the Upper Hudson River, provided a case study to examine the planning-evaluation-decision making processes as they relate to preservation-development conflicts. The Hudson River Gorge, focal point of the Gooley conflict, was visited by a total of 3900 people during the summers of 1972 and 1973. Questionnaires, with response rates from 85 to 87 percent, indicate an overwhelming desire to maintain the Gorge in its natural state. Major water resources planning programs were precipitated by the drought of the mid-1960's. Both Federal and State efforts identified the Gooley Reservoir as the most desirable alternative for meeting the water supply needs of the greater New York metropolitan area. Environmental parameters were examined but not given sufficient emphasis in initial planning efforts. Preservation interests, working through political processes, appear to have been more instrumental in preserving the Upper Hudson than were the planning agencies' attempts at environmental analysis.  
W75-09898

**METHODS OF ESTIMATING PHYSICAL AND ECONOMIC EFFECTIVENESS OF WEATHER MODIFICATION,**  
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).  
For primary bibliographic entry see Field 3B.  
W75-09991

**ECONOMIC ASPECTS OF PRECIPITATION AUGMENTATION OVER THE GREAT LAKES,**  
Illinois State Water Survey, Urbana.  
G. E. Stout.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No. 399, Geneva (Switzerland), p 431-438, 1974. 4 fig, 2 tab, 4 ref.

## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

Descriptors: \*Weather modification, \*Artificial precipitation, \*Benefits, \*Great Lakes, Cost-benefit analysis, Economics, Annual benefits, Lakes, Lake Michigan, Cloud seeding, Precipitation(Atmospheric), Rainfall, Snowfall.  
Identifiers: \*Lake level regulation.

It has been proposed by Dr. Helmut Weickmann that one could recycle, by cloud seeding, some of the evaporative water from the Great Lakes directly into one of the lakes. High evaporational rates occur when polar or arctic air masses cross an open warm water surface during the fall and early winter. The recycled water would be most beneficial during periods of low water levels in the lake system. The cloud physics aspects of such a water augmentation program were not discussed. It was assumed that a 10, 20, or 30% increase is within potential capability. The waters of the Great Lakes are used for power generation, shipping, recreation, and water supply. One would not want to seed the clouds during the period of high water. It is generally known that anytime the lake level exceeds the average lake level the benefits from extra water would be negligible. Losses to property are high when the lake levels approach their maximum levels. At the present time, Chicago has an adequate water supply from the lake, but as the demands increase and the population grows in the suburbs the city may eventually need to withdraw more water. The value of the water Chicago presently withdraws, plus the value of the benefits to navigation, power, and shore property from a 20% increase from cloud seeding during the critical years was estimated to be \$4.5 to \$6.8 million per year. Based on preliminary discussion with a commercial cloud seeder, the costs of a seeding program would be about \$500,000 per fall. Therefore, the benefits on the conservative side appear to be about 9 to 1. (See also W75-09944) (Sims-ISWS)  
W75-09992

**ON PHYSICAL AND ECONOMIC EFFECTIVENESS OF HAIL-SUPPRESSION PROJECTS,**  
Institute of Experimental Meteorology, Obninsk (USSR).

For primary bibliographic entry see Field 3B.

W75-09995

**PROCEEDINGS OF WORKSHOP CONFERENCE ON IDENTIFICATION OF METROPOLITAN AREA WATER RESOURCES PROBLEMS AND ASSOCIATED RESEARCH NEEDS IN MINNESOTA.**

Minnesota Univ., St. Paul. Water Resources Research Center.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 793, \$3.25 in paper copy, \$2.25 in microfiche. Oct 1973, 22 p. OWRT A-028-MINN(4). 14-31-0001-4023.

Descriptors: \*Water resources development, \*Minnesota, \*Research priorities, City planning, Comprehensive planning, Surveys, Land use, Coordination, Long-term planning.

Identifiers: \*Water resources problems, \*Minneapolis-St Paul Metropolitan area(Minn), Research needs.

The Water Resources Research Center, University of Minnesota, is developing a long-range comprehensive plan for water resources research in Minnesota involving Federal, State and local agencies, private organizations, Consultants, University of Minnesota, State and private Colleges, Interest Groups, and citizens. An attempt is being made to formulate broad research guidelines by inventorying research needs and assigning priorities. The object of this Workshop Conference was to identify research needs and priorities for the Minneapolis-St. Paul Metropolitan area in Minnesota. Conference participants identified the following high priority needed water resources research topics: Development of Water Resources Information System and Data Banks; Conservation of Water

Resources; Groundwater System Analysis; State-wide Water Resources Planning; Solving Water Supply Problems in Twin Cities Metropolitan Area; Institutional Arrangements for Coordinating Water Resources Programs; On-Land Waste Disposal Practices; Financing Water Resources Programs; Shoreland, Floodplain and Water Surface Zoning; and Integrating Land-Use and Water Resources Planning. (Walton-Minnesota)  
W75-10004

**PROCEEDINGS OF PUBLIC WORKSHOP CONFERENCE ON WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN CENTRAL MINNESOTA.**

Minnesota Univ., St. Paul. Water Resources Research Center.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 813, \$3.25 in paper copy, \$2.25 in microfiche. October 1973, 10 p. OWRT A-028-MINN(6). 14-31-0001-4023.

Descriptors: \*Water resources development, \*Minnesota, \*Comprehensive planning, \*Research priorities, Coordination, Surveys, Long-term planning.

Identifiers: \*Water resources problems, Research needs.

The Water Resources Research Center, University of Minnesota, is developing a long-range comprehensive plan for water resources research in Minnesota involving Federal, State and local agencies, private organizations, Consultants, University of Minnesota, State and private Colleges, Interest Groups, and citizens. An attempt is being made to formulate broad research guidelines by inventorying research needs and assigning priorities. The object of this Workshop Conference was to identify research needs and priorities for Central Minnesota. Conference participants identified the following high priority needed water resources research topics: Groundwater Pollution Hazards, Pollution Potentials in Lake Watersheds, Water Information System, Lake Management and Restoration Program, Water Resources Educational Programs, Thermal Pollution Standards and Credibility of Research Results. (Walton-Minnesota)  
W75-10005

**PROCEEDINGS OF PUBLIC FORUM ON WATER RESOURCES PROBLEMS AND RESEARCH NEEDS IN SOUTHWESTERN MINNESOTA.**

Minnesota Univ., St. Paul. Water Resources Research Center.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 794, \$3.25 in paper copy, \$2.25 in microfiche. October 1973, 12 p. OWRT A-028-MINN(5). 14-31-0001-4023.

Descriptors: \*Water resources development, \*Minnesota, \*Research priorities, Water quality,

\*Comprehensive planning, Coordination, Surveys, Long-term planning.

Identifiers: \*Water resources problems, Research needs.

The Water Resources Research Center, University of Minnesota, is developing a long-range comprehensive plan for water resources research in Minnesota involving Federal, State and local agencies, private organizations, Consultants, University of Minnesota, State and private Colleges, Interest Groups, and citizens. An attempt is being made to formulate broad guidelines by inventorying research needs and assigning priorities. The object of this Workshop Conference was to identify research needs and priorities for Southwestern Minnesota. Conference participants identified the following high priority needed water resources research topics: Acceleration of Soil Conservation Practices, Reducing Waste Treatment Requirements Changes, Preventing Water Quality Deterioration through Soil Conservation Practices, Preventing Groundwater Pollution, Water Resources Information Dissemination, Preservation of Wetlands, Erosion Control, and Relation Between Tax Base and Land Retirement Policies. (Walton-Minnesota)  
W75-10006

ment Changes, Preventing Water Quality Deterioration through Soil Conservation Practices, Preventing Groundwater Pollution, Water Resources Information Dissemination, Preservation of Wetlands, Erosion Control, and Relation Between Tax Base and Land Retirement Policies. (Walton-Minnesota)  
W75-10006

**PROCEEDINGS OF PUBLIC FORUM ON WATER RESOURCES PROBLEMS IN SOUTHEASTERN MINNESOTA.**

Minnesota Univ., St. Paul. Water Resources Research Center.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 814, \$3.25 in paper copy, \$2.25 in microfiche. October 1973, 11 p. OWRT A-028-MINN(3). 14-31-0001-4023.

Descriptors: \*Water resources development, \*Minnesota, Comprehensive planning, \*Research priorities, Long-term planning, Coordination, Surveys, \*Water quality.

Identifiers: \*Water resources problems, Research needs.

The Water Resources Research Center, University of Minnesota, is developing a long-range comprehensive plan for water resources research in Minnesota involving Federal, State and local agencies, private organizations, Consultants, University of Minnesota, State and Private Colleges, Interest Groups, and citizens. An attempt is being made to formulate broad research guidelines by inventorying research needs and assigning priorities. The object of this Forum was to identify research needs and priorities for southeastern Minnesota. Forum participants identified the following high priority needed water resources research topics: Groundwater Quality, Groundwater Standards, Effects of Drainage on Groundwater, Wastewater Treatment, Land Use, Reuse and Recycling of Water, Agricultural Drainage, Interdisciplinary Research, and Research on Research Needs. (Walton-Minnesota)  
W75-10007

**A STUDY OF WATER RESOURCES RESEARCH NEEDS IN MONTANA,**

Montana State Univ., Bozeman. Dept. of Geology. C. C. Bradley.

Available from the National Technical Information Service, Springfield Va., 22161, as PB-243 815, \$3.75 in paper copy, \$2.25 in microfiche. Research Report No 64, Montana University Joint Water Resources Research Center, Bozeman, December 1969, 26 p. OWRT A-026-MONT(1).

Descriptors: \*Research and Development, \*Planning, \*Montana, Research priorities, Water resources, Administration.

Identifiers: \*Research needs, \*Multi-disciplinary Research, \*Interdisciplinary research.

Many important current problems require applied research and interdisciplinary or multidisciplinary efforts. The objectives of this project were to define major areas of interdisciplinary or multidisciplinary research requiring attention in Montana and to consider alternative administrative structures that will facilitate research efforts not well adapted to the traditional departmental structure of the Montana State University. (Holje-Montana State)  
W75-10012

**IRRIGATION EFFICIENCIES IN PRODUCING CALORIES AND PROTEINS: AN ANNOTATED BIBLIOGRAPHY,**

California Univ., Los Angeles. School of Public Health.

For primary bibliographic entry see Field 3F.

W75-10076

## WATER RESOURCES PLANNING—Field 6

### Evaluation Process—Group 6B

**WASTING A RIVER,**  
California Univ., Berkeley. Coll. of Natural Resources.  
B. T. Parry, and R. B. Norgaard.  
Environment, Vol 17, No 1, p 17-26, 1975. 1 tab.

Descriptors: \*Economic justification, \*Cost-benefit analysis, \*Economic prediction, \*Discount rates, \*Dams, Cost analysis, Flood control, Hydroelectric power, Irrigation effects, Recreation, Rivers, \*California, Natural resources, Preservation, Reservoirs, Engineers estimates, Estimated benefits, Estimated costs, Reliability. Identifiers: New Melones Dam(Calif), \*Stanislaus River(Calif), Environmental costs.

Estimated costs and benefits from a Corps of Engineers benefit-cost analysis are re-evaluated with emphasis on the degree to which sponsoring agencies can arrange factors in a light favorable to their own projects. The New Melones Dam project on the Stanislaus River, California has been analyzed for costs and benefits several times since 1961, the 1972 environmental impact statement analysis provided the summarized benefit-cost calculations here examined. Corps of Engineers estimates of benefits included the categories of flood control, irrigation, power generation, recreation, fish and wildlife, water quality, and area development. High and low values are calculated in the reevaluation for each benefit component. While the power generation benefits are accepted provisionally, the estimated high value for the other benefits is less for each component than in the Corps analysis. Flood benefits were overstated by a factor of two as a result of using the average benefit from a series of projects. A \$3.6 million discrepancy for irrigation occurred because an anticipated crop price reduction was not taken into account. Other components were over estimated due to a range of oversights. The estimated project cost used in the original benefit-cost ratio was low as a result of using an incorrectly calculated discount rate. (Becker-Wisconsin)  
W75-10116

#### THE BENEFIT-COST RATIO IN RESOURCE DEVELOPMENT PLANNING,

Economic Research Service, Washington, D.C.

G. A. Pavlis.

Southern Journal of Agricultural Economics, Vol 3, No 4, p 161-166, 1971. 4 fig, 1 tab, 15 ref.

Descriptors: \*Cost-benefit ratio, \*Project planning, \*Economic efficiency, \*Evaluation, \*Optimization, Mathematical studies, Return to scale, Resource mix.

The mathematical ratio of total capitalized benefits over total capitalized costs can mislead planners and legislators to invest capital and other inputs in less than fully efficient patterns of resource development. The benefit-cost ratio is examined for both linear and nonlinear cost functions, and in terms of capital restrictions and rates of return. The benefit-cost ratio as popularly computed in resource evaluations is an appropriate criterion for allocation decisions if the ratio does not change with the amount of money represented by the total cost, i.e., there is a straight-line relation between total costs and total benefits. Where benefit-cost relationships are not linear, projects can be compared validly by the benefit-cost ratio criterion alone only if the scale is fixed at the same cost level among alternatives. Proper use of the benefit-cost ratio in appraising projects with a nonlinear function reflects changes in the relation as costs are changed. If only one project with a nonlinear function is being considered, the economic rule is to incur costs to the point where added total cost is equal to added total benefit. The general rule for a multi-project series is to incur costs such that marginal net benefits are the same in all projects undertaken. (Becker-Wisconsin)  
W75-10117

#### PRIMARY ECONOMIC IMPACT OF THE GULF INTRACOASTAL WATERWAY IN TEXAS,

Texas Engineering Experiment Station, College Station.

J. Miloy, and C. Phillips.

Available from the National Technical Information Service, Springfield, Va 22161 as COM-74-11552, \$7.25 in paper copy, \$2.25 in microfiche. Sea Grant Program Report TAMU-SG-74-211, March 1974. 213 p, 39 fig, 38 tab, 45 ref.

Descriptors: \*Input-output analysis, \*Industrial production, \*Texas, \*Economic impact, \*Inland waterways, Gulf coastal plain, Chemical industry, Oil industry, Barges, Land use, Transportation, Projections.

Identifiers: \*Gulf Intracoastal Waterway, Commodity flow.

Industrial development in Texas reflects the continuing economic importance of water transportation as nearly three-fourths of the state's goods move by low-cost water transportation modes. Over 21 million acres adjoining the Texas shoreline constitute the state's coastal zone. An economic impact analysis, using input-output techniques, evaluating underlying processes linking various sectors of the economy, is presented for the coastal zone. Of the \$1.77 billion which the Intracoastal Waterway directly contributes to the state's economy, the major components are from the water transportation industry and from the cargo value received from deep draft ports. A land use summary of the areas contiguous to the Texas portion of the Gulf Intracoastal Waterway indicates that this region is becoming increasingly attractive to firms that require high-volume low-cost transportation. Commodity flow statistics presented point to the chemical, crude petroleum and petroleum products industries as primary users. To facilitate the movement of these commodities, expanded and more efficient inland river systems and barges are needed. The future economic impact of the Intracoastal Waterway in Texas is determined based on anticipated demand for water transportation, which is influenced primarily by industrial growth in the coastal region and the cost of competing modes of transportation. (Becker-Wisconsin)  
W75-10120

#### THE EFFECTS OF AUTHORIZATION FOR WATER IMPOUNDMENTS ON SHORELAND TRANSITION,

North Carolina Univ., Chapel Hill. Center for Urban and Regional Studies.

S. F. Weiss, R. J. Burby, and T. G. Donnelly.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 880, \$3.25 in paper copy, \$2.25 in microfiche. Preliminary Completion Report, 1971. 11 p, 6 tab. OWRT B-025-NC(1).

Descriptors: \*Planning, \*Land development, \*Reservoirs, \*Impoundments, Urbanization, \*Land use, \*North Carolina, Shores, \*Social change, \*Social values, \*Property values, Pre-impoundment, Reservoir sites.

Identifiers: New Hope Reservoir(NC), Falls Reservoir(NC).

Objectives were to: (1) Identify and evaluate factors which explain the location of land transactions, changes in land prices or value, and changes in land use patterns which occur after the authorization of water impoundments. (2) Develop and test a model to predict short-term changes in land ownership, land value, and land utilization. (3) Develop a system for monitoring changes in land values, land use, and predictive factors utilized in the transition model as they occur in reservoir areas. (4) Prepare policy guides to enable the Corps of Engineers and state and local governmental agencies to prevent the exploitation of land in authorized reservoir areas and to facilitate desirable development to meet public land use objectives. Research completed included: (1)

delineation and mapping of the authorized reservoir study areas; (2) identification of all individuals, firms, and institutions owning property and all sales and transactions occurring in the reservoir study areas during a period extending five years prior to reservoir authorization through 1969; (3) identification of land use changes in the reservoir study areas between 1963 (before authorization) and 1970; (4) analysis of the impact of reservoir authorization in terms of yearly land sales and average sales prices before and after authorization; and (5) analysis of the characteristics and attitudes of pre-authorization landowners. (Howells-North Carolina State) W75-10126

#### CLASSIFICATION OF FRESHWATER WETLANDS IN THE GLACIATED NORTHEAST,

Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.

F. C. Golet, and J. S. Larson.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 852, \$4.25 in paper copy, \$2.25 in microfiche. U.S. Bureau of Sport Fisheries and Wildlife, Resource Publication 116, 1974. For sale by the Superintendent of Documents, U.S. Government Printing Office, Wash., D.C. Price \$1.15. 56 p, 5 fig, 1 tab, 27 plates, 57 ref. OWRT

Descriptors: \*Wetlands, \*Wildlife, Classification, \*Northeast United States, New England, \*Land classification, New York, Pennsylvania, New Jersey, Aerial photography, Land use, Vegetation.

A wetland classification system based on life forms and sub-forms of vegetation is offered for glaciated New England, New York, Pennsylvania and New Jersey. It is compatible with currently used national and regional systems, but emphasizes maximum wetland production and diversity rather than waterfowl alone. An example of the application of the system employing aerial photography is provided as are 27 photographic plates of the several classes and sub-classes. W75-10128

#### ACTIVITIES, CHARACTERISTICS, AND OPINIONS OF LAKEFRONT RESIDENTS: KISSIMMEE RIVER BASIN, FLORIDA,

Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.

J. R. Conner, J. E. Reynolds, and K. C. Gibbs.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 882, \$4.25 in paper copy, \$2.25 in microfiche. Bulletin 755, January 1973. 68 p, 1 fig, 28 tab. OWRT B-005-FLA(3) and OWRT B-007-FLA(9). 14-31-0001-3267.

Descriptors: \*Water allocation(Policy), Water values, Water utilization, Water demand, Decision making, \*Florida, \*Attitudes, Water districts, \*Property values, Aesthetics, Social values, \*Water level fluctuations, \*Recreation demand.

Identifiers: Kissimmee River basin(Fla), Lakefront residents.

Water in the Kissimmee River Basin can be controlled by the Central and Southern Florida Flood Control District. Both fluctuating and excessively low water levels have adverse impacts on the residents adjacent to the lakes and streams. In order to assess these impacts on the lakefront property and on aesthetic values held by the residents, studies are needed to identify the population of persons affected, to ascertain their opinions concerning various qualities of the lakes, and to determine the amount of lake use by these residents. The recreational users of the Kissimmee River Basin are of two types: (1) recreational visitors and (2) waterfront residents. This study was concerned with recreational data from a sample of waterfront residents in the Kissimmee River Basin. It was designed to obtain information regarding property values, recreational activities of the residents, ef-

## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

fects of different water levels on the participation in different recreational activities, and opinions of the residents regarding the value of lakefront property as compared to other types of property. It was also concerned with the analysis and interpretation of the data obtained from this survey. (Morgan-Florida) W75-10129

#### A MATHEMATICAL PROGRAMMING APPROACH TO PUBLIC WATER PROJECT PORTFOLIO SELECTION, Georgia Univ., Athens.

W. P. Neely.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 844, \$6.25 in paper copy, \$2.25 in microfiche. Ph.D. Dissertation, 1974, 161 p, 24 tab, 70 ref, 5 append. OWRT A-040-GA(3) 14-31-0001-3810.

Descriptors: Model studies, Projects, Multiple purpose, Cost-benefit ratio, Cost trends, Tennessee Valley Authority, \*Mathematical studies, \*Linear programming, \*Capital, Budgeting, \*Benefits, \*Costs, \*Long-term planning.  
Identifiers: Multiple objectives, Portfolio selection, Net present value.

A model for selecting water resources projects for inclusion in portfolios of investment opportunities using mathematical programming techniques was developed and tested for several Tennessee Valley Authority projects. The portfolio approach was suggested as operationally superior to the independent project selection approach based on maximum benefit-cost ratio (BCR). The relationships of each project to each other project and to the expected budgets are accounted for with the portfolio approach. The (integer) programming method was suggested as a more effective method of portfolio selection than ranking by the maximum BCR. The optimum portfolio solution differs from the BCR solution due both to the complexity of the water resources problem and to the inadequacy of the BCR criterion. Long-term budget level determination was facilitated by the linear programming methods and individual project scheduling was improved by the programming method. The effects of uniform variation in costs and benefits were significant only in the case of variation in costs. Multiple objectives—economic and environmental improvement were incorporated into the model by use of the goal programming approach. Projects selected using the programming approach for portfolio selection were found to be different from those selected by BCR criteria and deemed superior or on the basis of both net present value (NPV) and goal contribution. W75-10131

**EVOLVING NATIONAL WATER POLICIES,**  
Water Resources Council, Washington, D.C.  
For primary bibliographic entry see Field 6E.  
W75-10201

**MEAN ESTIMATE DEFICIENCIES IN WATER QUALITY STUDIES,**  
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.  
For primary bibliographic entry see Field 5G.  
W75-10202

**OBJECTIVES OF WATER QUALITY PLANNING,**  
Kansas Water Resources Board, Topeka.  
For primary bibliographic entry see Field 5G.  
W75-10205

**ISSUES IN WATER RESOURCES IMPACT ASSESSMENT,**  
Stanford Univ., Calif. Dept. of Civil Engineering.  
L. Ortolano.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY1, Paper No 10292, p 173-187, January 1974. 2 fig, 14 ref.

Descriptors: Water resources, \*Water management(Applied), \*Reservoirs, \*Environmental effects, \*Assessment, Evaluation, Planning, Decision making, \*California, Environment, Social change.  
Identifiers: \*Impact prediction, \*Carmel Valley(Calif).

Formal impact assessment, defined as the identification, description, and evaluation of changes associated with proposed actions, has been mandated by recent legislation relevant to Federal water resources agencies. An example involving proposed reservoirs in Carmel Valley, California to illustrate various concepts is introduced. Demonstrated is how 'evaluative factors'—defined as the goals, concerns, constraints, etc., that affected publics and other decision makers consider in ranking alternative actions—can be used in deciding on which impacts to forecast and at what levels of detail. Presented is a classification of 'causative factors' which encourages a systematic examination of the various aspects of a proposed action that may bring about change. Network diagrams of cause-effect relations, and the problems associated with the analysis of indirect impacts are also analyzed. The paper summarizes a number of characteristics of impact which can be used in describing the results of an impact assessment. Questions related to communication are especially important since a main reason for conducting an assessment is the development and communication of information to help people understand issues and make choices. (Bell-Cornell)  
W75-10222

#### A SENSITIVITY ANALYSIS OF SIMULATED RIVER BASIN PLANNING FOR CAPITAL BUDGETING DECISIONS.

Idaho State Univ., Pocatello. Coll. of Business.  
For primary bibliographic entry see Field 6A.  
W75-10223

#### PLANNING AND OPERATION OF URBAN WATER QUALITY MANAGEMENT SYSTEMS,

Cornell Univ., Ithaca, N.Y.  
For primary bibliographic entry see Field 5G.  
W75-10262

#### ALABAMA'S WATER RESOURCES POLICY.

Alabama Development Office, Montgomery.  
For primary bibliographic entry see Field 5G.  
W75-10310

#### PLAN FORMULATION AND EVALUATION STUDIES—RECREATION. VOL I OF V. EVALUATION OF RECREATION USE SURVEYS PROCEDURES,

Army Engineer District, Sacramento, Calif.  
R. E. Brown, D. A. Crane, and A. M. Kinsky.  
Army Engineer Institute of Water Resources IWR Research Report 74-R1, June 1974. 53 p, 8 fig, 2 tab, 3 append.

Descriptors: \*Use rates, \*Reservoirs, \*Estimating, \*Recreation, \*Surveys, Sampling, Data collections, Methodology.  
Identifiers: Stratified sampling, Statistical sampling designs.

An evaluation of the data collection program developed by the Corps of Engineers Sacramento District in 1966 is made and improved alternative survey procedures applicable for nationwide surveys at reservoir sites are suggested. Survey designs are evaluated with the criteria of reliability, efficiency, and fit. Survey data collected from visitors to recreational facilities are incorporated into the planning processes and the administration of Corps of Engineers civil works reservoir pro-

jects. Three years of data collection under the Sacramento District design have emphasized an inherent limitation—no precise quantitative estimate regarding the reliability of sample results can be made. The limitation lies within the intuitively controlled selection of sample areas and survey days. Four alternative sampling procedures were compared on least cost and reliability criteria. The procedures were (1) complete random sampling, (2) sampling stratified on the basis of homogeneous projects, (3) sampling using the ratio of attendance to traffic count at the randomly drawn sample value, and (4) the stratification of design 2 combined with the ratio estimates of design 3. The stratified designs (2 and 4) were the least cost and the ratio sample value designs (3 and 4) gave the highest reliability (lowest standard errors). Alternative sample design 4 appears most feasible. (See W75-10343 thru W75-10345) (Becker-Wisconsin) W75-10342

#### PLAN FORMULATION AND EVALUATION STUDIES—RECREATION. VOL. III OF V. A PRELIMINARY ANALYSIS OF DAY USE RECREATION AND BENEFIT ESTIMATION MODELS FOR SELECTED RESERVOIRS,

Army Engineer District, Sacramento, Calif.  
R. E. Brown, and W. J. Hansen.  
Army Engineer Institute for Water Resources, Fort Belvoir, Va., IWR Research Report 74-R1, June 1974. 78 p, 5 fig, 6 tab, 17 ref, 3 append.

Descriptors: \*Recreation demand, \*Estimating, \*Reservoirs, \*Regional analysis, \*Estimated benefits, Water resources development, Regression analysis, Recreation facilities, \*California, \*Texas, Statistical models, Model studies, Methodology.  
Identifiers: Sacramento(Calif), Fort Worth(Texas).

A multiple linear regression analysis for estimating recreation demand and benefits is presented. The models discussed are intended as bases for evolving an acceptable procedure for developing plans for recreation and other aspects of water resources. Day use recreation estimators are developed from regression analysis of recreation use survey data collected at 19 reservoirs in the Fort Worth and Sacramento Army Corps of Engineers Districts. Three general classifications of variables were considered: county specific, reservoir specific, and reservoir-county relationships. The variables included county population, land density and median family income; shoreline miles, accessible shoreline miles, water surface area, total project area, project land, average annual precipitation, age of reservoir, length of growing season; and road mile distance between the most populous city in the county and the nearest reservoir access. Travel-cost is employed as a proxy for price to derive demand schedules from the regional estimators. The methodology presented is of great scope and intensity than other estimating procedures, which were site specific rather than regionally oriented. This methodology can be replicated, and the technique can be usefully employed by Corps of Engineers recreation planners. However, recreational use data of increasing quality are required as input. (See also W75-10342) (Becker-Wisconsin) W75-10343

#### PLAN FORMULATION AND EVALUATION STUDIES—RECREATION. VOL. IV OF V. ESTIMATING RECREATIONAL FACILITY REQUIREMENTS,

Army Engineer District, Sacramento, Calif.  
R. E. Brown, and G. Mueller.  
Army Engineer Institute of Water Resources IWR Research Report 74-R1, June 1974. 28 p, 2 tab, 7 ref, 1 append.

Descriptors: \*Methodology, \*Recreation demand, \*Reservoirs, \*Estimating, \*Recreation facilities, Cost-benefit analysis, Use rates, Camp sites, Boat-launching ramps, Planning.

## WATER RESOURCES PLANNING—Field 6

### Water Demand—Group 6D

Identifiers: Facility design day load, Turnover rate, Picnicking.

Data collected at 52 reservoirs during 1966-1969 were utilized to develop a general methodology for estimating the number and type of principal recreational facilities needed to serve a given number of recreation days at a proposed reservoir. This method synthesizes planner judgement, existing recreation use data, and the concepts of estimating annual recreational use employed by the Corps of Engineers. The facility requirements planning methodology developed assumes the size of the proposed reservoir site has been determined and annual total recreational use estimates have been computed, implying that the planning process under consideration is one of accommodating recreational use. In the computation of recreational use estimates, the concepts of design day, facility design day load and maximum practical use are used. Facility design day load, proportion of total use, average party size and turnover rate are factors considered in the estimation of facility requirements for picnic tables, camp sites and boat-launching lanes. A benefit-cost analysis for recreational facilities, using a proposed project campground as an example, is appended. Although the limitation of this benefit-cost analysis may be severe, when used in conjunction with design day analysis, it is informational for recreational planning purposes. (See also W75-10342) (Becker-Wisconsin)  
W75-10344

**PLAN FORMULATION AND EVALUATION STUDIES—RECREATION. VOL. V OF V. A GENERALIZED RECREATION DAY USE PLANNING MODEL,**  
Army Engineer District, Sacramento, Calif.  
R. E. Brown, and W. J. Hansen.  
Army Engineer Institute for Water Resources, Fort Belvoir, Va., IWR Research Report 74-R1, June 1974. 43 p., 3 fig, 5 tab, 22 ref.

Descriptors: \*Recreation demand, \*Estimating, \*Reservoirs, \*Regional analysis, \*Estimated benefits, Water resources development, Regression analysis, Recreation facilities, Southwest U.S., \*California, Statistical models, Model studies, Forecasting, Methodology.  
Identifiers: Sacramento(Calif).

Procedural guidelines for estimating reservoir recreation use and benefits for planning water resources development is presented. A general planning model that includes regional estimators for predicting recreation use of proposed reservoir projects and for predicting individual project demand schedules and recreation benefits is described and replicated. The economic value of recreation as a water resource project output is measured by the willingness to pay for the amount of recreation consumed. The previous procedure was to estimate benefits as the product of a 'unit day value' multiplied by estimated total recreation days. Since the estimation of unit day values was a poor approximation, a theoretical model—the travel-cost approach—was developed. The justification of using travel-cost as an estimator of recreation benefit is derived from the differences between outdoor recreation and most consumer goods: (1) the market price is usually nominal or zero, and (2) travel costs are large relative to market price. Other factors influencing the user's willingness to pay include proximity to site, site attributes and the availability of substitutes. Estimators are developed on a regional basis for the Sacramento and Southwestern Divisions of the Corps of Engineers, with the Southwest divided into uniquely large reservoirs and remaining reservoirs. (See also W75-10342) (Becker-Wisconsin)  
W75-10345

### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**PROJECT EVALUATION IN WATER RESOURCES: BUDGET CONSTRAINTS,**  
Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6A.  
W75-09851

**THE ECONOMIC IMPACT OF A SMALL RECREATION-ORIENTED RESERVOIR,**  
University of Southern Mississippi, Hattiesburg, Bureau of Business Research.  
For primary bibliographic entry see Field 6B.  
W75-09857

**METHODS TO FACILITATE MANAGERIAL EFFECTIVENESS IN MUNICIPAL WATER SYSTEMS,**  
Mississippi State Univ., Mississippi State, Bureau of Business and Economic Research.  
For primary bibliographic entry see Field 6B.  
W75-09895

**CARBON CONTACT-FILTRATION: HOW IT WORKS,**  
Seelye, Stevenson, Value, and Knecht, New York.  
For primary bibliographic entry see Field 5D.  
W75-09912

**A GENERAL LINEAR APPROACH TO STREAM WATER QUALITY MODELING,**  
IBM Federal Systems Div., Gaithersburg, Md.  
For primary bibliographic entry see Field 5B.  
W75-09917

**JOINT TREATMENT OF PULPING AND MUNICIPAL WASTES,**  
Procter and Gamble Co., Cincinnati, Ohio. Environmental Control Section.  
For primary bibliographic entry see Field 5D.  
W75-09928

**MUNICIPALITY AND INDUSTRY JOIN IN WASTEWATER TREATMENT.**  
For primary bibliographic entry see Field 5D.  
W75-09929

**THE BENEFIT-COST RATIO IN RESOURCE DEVELOPMENT PLANNING,**  
Economic Research Service, Washington, D.C.  
For primary bibliographic entry see Field 6B.  
W75-10117

**A THEORETICAL AND EMPIRICAL APPROACH TO FISHERIES ECONOMICS,**  
Victoria Univ. of Manchester (England). Dept. of Agricultural Economics.  
J. M. Tomkins, and J. A. Butlin.  
Journal of Agricultural Economics, Vol 26, No 1, p 105-124, 1975. 10 fig, 5 tab, 17 ref.

Descriptors: \*Marine fish, \*Fisherries, \*Fish management, \*Commercial fishing, \*Model studies, Fish populations, Economic efficiency, Fish conservation, Regulation.  
Identifiers: \*Externalities, \*Common-property resources, Manx Herring Fishery(England), Government appropriation.

The free competitive exploitation of a fishery as a common-property resource leads to an over-allocation of inputs to that fishery. A simple theoretical model developed to represent the commercial exploitation of the fishery is built around (1) the biological relationship between absolute increase

in fish stock per time period and fish population size, and (2) the relationship between fishing yield and effort expended. The policy implications of the theory are that the fishery must be appropriated, preferably by the government, so that entry to the fishery can be restricted and exploitation maintained at the optimal level. The absence of such a policy leads to entry of new units into the fishery until excess profits are competed away, at which point the level of effort is greater than that is compatible with maintenance of the fish population. Each individual unit ignores the external effects of the demise of the fish population. An empirical study is presented that applies the theoretical model to the Manx Herring Fishery and investigated its economic efficiency and biological viability. Limitations of the model include: (1) its long-run static nature, and (2) the assumption of certain biological knowledge (which is not known) concerning the growth curves of the species under study. (Becker-Wisconsin)  
W75-10118

**GEOGRAPHICAL ANALYSIS OF OIL SPILL POTENTIAL ASSOCIATED WITH ALASKAN OIL PRODUCTION AND TRANSPORTATION SYSTEMS,**  
Battelle-Pacific Northwest Labs., Richland, Wash.  
For primary bibliographic entry see Field 5G.  
W75-10121

**A COMPUTER SIMULATION ANALYSIS OF SURFACE WATER QUALITY MANAGEMENT POLICIES UNDER DYNAMIC ECONOMIC AND HYDROLOGIC CONDITIONS,**  
Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.  
For primary bibliographic entry see Field 5D.  
W75-10124

**A MATHEMATICAL PROGRAMMING APPROACH TO PUBLIC WATER PROJECT PORTFOLIO SELECTION,**  
Georgia Univ., Athens.  
For primary bibliographic entry see Field 6B.  
W75-10131

**NEEDED: \$350 BILLION - AND A NEW NEEDS SURVEY,**  
For primary bibliographic entry see Field 5D.  
W75-10174

**SECONDARY TREATMENT DESIGN FOR COMBINED WASTEWATERS, PART II,**  
For primary bibliographic entry see Field 5D.  
W75-10199

**A CONCEPT FOR MANAGING WASTE,**  
Gulf Waste Disposal Authority, Houston, Tex.  
For primary bibliographic entry see Field 5D.  
W75-10236

**HOW MUCH 'RELIABILITY' IS 'ENOUGH',**  
For primary bibliographic entry see Field 5A.  
W75-10254

### 6D. Water Demand

**FEASIBILITY AND POTENTIAL OF ENHANCING WATER RECREATION OPPORTUNITIES ON HIGH COUNTRY RESERVOIRS-PHASE I,**  
Colorado State Univ., Fort Collins. Dept. of Recreation Resources.  
For primary bibliographic entry see Field 6B.  
W75-09894

## Field 6—WATER RESOURCES PLANNING

### Group 6D—Water Demand

#### WATER AND WATER PROBLEMS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND SOME POSSIBLE SOLUTIONS.

Southwest Florida Water Management District, Brooksville.

For primary bibliographic entry see Field 3C.

W75-10207

### 6E. Water Law and Institutions

#### GEORGIA COUNTY COMMISSIONER ATTITUDES TOWARD WATER PROBLEMS,

Georgia Univ., Athens. Dept. of Political Science.

V. L. Marano.

Available from the National Technical Information Service, Springfield, Va. 22161 as PB-243 578, \$4.25 in paper copy, \$2.25 in microfiche. Georgia Environmental Resources Center, Atlanta, Report No. ERC-0775, June 1975. 49 p, 7 tab, 8 ref, 1 append. OWRT A-045-GA(1). 14-31-000-4010.

Descriptors: \*Attitudes, \*Local governments, Water resources development, Political aspects, \*Institutions, \*Governmental interrelations, Institutional constraints, Georgia, Florida, \*Water policy.

Identifiers: \*County officials, Problem identification, Governmental responsibility.

The objective was to examine the attitudes of Georgia county commissioners toward water problems. The identification of water problems is necessary and precedes county decisions and policy on water issues. Commissioners attitudes toward water problems were examined within the context of all major issues which confront county commissioners. The basic assumption was that water issues constitute only a portion of the agenda of problems that confront commissioners. Three major conceptual components utilized for examining water issues were problem identification, problem severity and governmental responsibility. Eleven percent of the Georgia commissioners, as opposed to 17 percent of Florida commissioners, saw water and sewer problems as one of the two most pressing problems facing their county. When asked for details, even fewer Georgia commissioners identified any severe water problems. Furthermore, most commissioners viewed the responsibility for solving these problems as largely belonging to other governmental units. (James-Geo Tech).

W75-09855

#### INDUSTRY VIEWPOINT (WATER QUALITY CONTROL),

Mobil Oil Corp., New York.

For primary bibliographic entry see Field 5G.

W75-09885

#### LATITUDINAL ASPECTS OF THE LAW OF THE SEA AND OF PETROLEUM PRODUCTION,

Woods Hole Oceanographic Institution, Mass.

K. O. Emery.

Ocean Development and International Law Journal, Vol 2, No 2, p 137-149, 1974. 11 fig, 5 ref.

Descriptors: \*International law, \*Mineral industry, Land, Oceans, Population, Oil, Oil fields, Oil industry, International waters, International commissions, Industrial production, Taxes.

Identifiers: International agreements, State policy.

The land areas of the world lie mainly between 30 degrees S. Latitude and 70 degrees N. Latitude. Plans for ocean-floor sovereignty change this pattern very little. Probably by coincidence the latitudes of maximum population are the same as the latitudes of maximum oil production (20 degrees to 40 degrees N. Latitude). By contrast, the greatest concentrations of nations are farther south, and the greatest concentrations of gross na-

tional products are farther north. Addition of ocean floor to adjacent nations by rules now under consideration should not prompt undeveloped nations to concentrate upon claims to areas of ocean floor in the expectation that industrialized nations will extract the minerals and pay high taxes that might increase the standard of living in underdeveloped nations. Instead, these nations should recognize that most profits and jobs are found in the later stages of mining, manufacturing, distribution, and receiving of goods made from the minerals. Merely raising the prices of minerals or the taxes on them is not likely to solve the problem for underdeveloped nations because the price to these nations of manufactured goods is likely to be increased even more. (Gagliardi-Florida)

#### MARINE POLLUTION--LEGISLATION LITIGATION, UNDERWRITING--WHERE ARE WE, WHERE AWAY,

Lillick, McHose, Wheat, Adams, and Charles, Los Angeles, Calif.

For primary bibliographic entry see Field 5G.

W75-09886

#### THE FORGING OF THE UNION RECONSIDERED: A HISTORICAL REFUTATION OF STATE SOVEREIGNTY OVER SEABEDS,

Columbia Univ., N.Y. School of Law.

R. B. Morris.

Columbia Law Review, Vol 74, p 1056-1093, 1974. 215 ref, append.

Descriptors: \*Continental shelf, \*Atlantic Ocean, \*Oil, \*Oil industry, Energy, Subsoil, United States, Oceans, Navigation, State governments, State jurisdiction.

Identifiers: Energy crises.

The resolution of *United States v. Maine* will determine whether the states or the federal government has title to the continental shelf off the Atlantic coast. The litigation stems from the search for new sources of oil and gas as a response to the energy crisis. The defendant states, resisting the federal government's assertion of sovereignty over the seabed and subsoil off the Atlantic coast, predicate their claim on English law and specific colonial grants and charters. Critical to the states' claim is the contention that their existence as independent sovereignties preceded the formation of the national government. The United States, on the other hand, maintains that any rights to the seas, seabed and subsoil existed as an incident of external sovereignty, which it alone possessed as the sole sovereign entity to merge upon the issuance of the Declaration of Independence, if not before. The historical evidence indicates that the United States collectively asserted its jurisdiction over navigation even before the formation of the states. To argue that the states' assertion of a proprietary interest over the seabed and subsoil does not necessarily conflict with the federal domain over external affairs would be to ignore geographical realities, essential national defense concerns, critical energy needs and the whole course of American constitutional history. (Gagliardi-Florida)

W75-09888

#### WATER RESOURCES PUBLICATIONS RELATED TO THE STATE OF NEBRASKA THIRD EDITION.

Nebraska Univ., Lincoln. Water Resources Research Inst.

For primary bibliographic entry see Field 10C.

W75-10015

#### A STUDY OF THE EFFECTS OF WATER INSTITUTIONS ON PLANNING AND MANAGEMENT OF WATER RESOURCES IN UTAH,

Utah State Univ., Logan. Dept. of Civil Engineering.

D. H. McLean.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 883, \$9.25 in paper copy, \$2.25 in microfiche. Ph.D. dissertation, June 1972. 302 p, 5 tab, 8 fig, 139 ref. OWRT B-037-UTAH(2). 14-31-000-3134 OWRR.

Descriptors: Institutions, Water rights, Water resource, \*Planning, \*Utah, Water districts, Irrigation, \*Institutional constraints, \*Management, \*Water law, Water users, Water utilization, Water allocation(Policy).

Identifiers: \*Weber Basin(Utah).

Over the years each state has developed a complex system of water law and organizations for the allocation and distribution of water. In many cases these institutions have imposed serious constraints upon the planning and the most efficient use of a valuable resource. This study has attempted to identify and define the many water institutions in the state of Utah including those which have statewide functions and those having restrictive or local functions. Federal agencies have not been defined except as they work through local or State organizations. An indepth study was made of the active water institutions in Weber County which included mutual irrigation companies, water users associations, irrigation districts, water conservancy districts, special improvement districts, private water companies and municipal water companies. A review of Utah State water law is also given. (Haus-Utah State)

W75-10130

#### ECONOMIC INSTITUTIONS TO DETERMINE WATER QUALITY,

Clemson Univ., S.C. Dept. of Economics.

For primary bibliographic entry see Field 5G.

W75-10132

#### EASING OF ENVIRONMENTAL LAWS,

For primary bibliographic entry see Field 5G.

W75-10173

#### LET'S TRY 90% FIRST AND SEE WHAT OUR QUALITY IS LIKE,

Wesleyan Univ., Middletown, Conn. Industrial Waste Lab.

For primary bibliographic entry see Field 5G.

W75-10175

#### REGIONAL AUTHORITIES TAKE OVER BRITAIN'S WATER/SEWAGE SYSTEMS,

J. Ardill.

Water and Sewage Works, Vol 121, No 68, p 72-73, August 1974. 1 fig.

Descriptors: \*Management, \*Legislation, \*Water management(Applied), Water supply, development, Sewage treatment, Water utilization, Reservoir operation, Government, \*Regional analysis, \*Water districts.

Identifiers: \*Water Authorities, England, Wales.

On April 1, 1974, some 1600 water supply, river management, sewerage and other water agencies of England and Wales were taken over by ten Water Authorities (WAs). This fundamental changeover was accomplished within nine months from the passage of the legislation. Apart from the three posts of chief executive and directors of finance and operations in each region, all other situations were filled from among those already employed in the industry or local government. The Yorkshire Water Authority in northern England has been able to solidify into the form of organization that is the goal of the reorganization; the concentration of all the diverse activities of the industry into a small number of territorial operating divisions with a single line of management from the divisional director to the regional director of operations. The philosophy of the Yorkshire WA is that the key to the integration of all the WAs' responsibilities, such as the conservation and supply of water,

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### Water Law and Institutions—Group 6E

removal and treatment of sewage, drainage and flood protection and the protection and enhancement of the amenity and recreational aspects of water space, is the river itself. Rather than the traditional situation, where management has been organized by professional hierarchies, the WAs are organizing on interdisciplinary lines to form a system of management integration. It is expected that the regional system will produce savings in administrative manpower, payroll, and elimination of unnecessary duplication in capital works. (Or-FIRL)  
W75-10176

**LACK OF PROMISED FEDERAL FUNDS HAM-PERS WATER CLEANUP EFFORT.**  
For primary bibliographic entry see Field 5G.  
W75-10178

**WATER POLLUTION LAW DRAWS FLOOD OF COMPLAINTS.**  
For primary bibliographic entry see Field 5G.  
W75-10179

**LEGISLATIVE HISTORY OF THE SAFE DRINKING WATER ACT,**  
House, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10186

**EVOLVING NATIONAL WATER POLICIES,**  
Water Resources Council, Washington, D.C.  
G. D. Cobb.  
Engineering Issues, Journal of Professional Activities, Proceedings of ASCE, Vol 101, No E13, Paper No 11427, p 375-382, July 1975.

Descriptors: \*Water resources development, \*Natural resources, \*Federal jurisdiction, \*Energy, Cost-benefit theory, Planning, \*Water policy, Regional analysis.  
Identifiers: \*Professional activities, \*Government agencies, Regional planning, Cost repayment.

The Federal role in developing a policy for water and related land resources planning is briefly outlined. The organization and functions of the U.S. Water Resources Council that were established by the Water Resources Planning Act, Public Law 89-80, are outlined. The major policy issues to which the Council is currently giving priority are discussed and include: (1) water for energy self-sufficiency; (2) the grant program authorized under Title III of Public Law 89-80; (3) level B planning under Section 209 of Public Law 92-500; (4) the Council's Principles and Standards for planning water and related land resources; and (5) Section 80 of the Water Resources Development Act of 1974 which calls for a 1-yr presidential study of the Principles and Standards for water resources planning, including planning objectives, cost sharing, and discount rates. (Bell-Cornell)  
W75-10201

**WATER AND WATER PROBLEMS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AND SOME POSSIBLE SOLUTIONS.**  
Southwest Florida Water Management District, Brooksville.  
For primary bibliographic entry see Field 3C.  
W75-10207

**SUBSURFACE ENVIRONMENT--PRIVATE PROPERTY OR PUBLIC DOMAIN,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.  
For primary bibliographic entry see Field 4B.  
W75-10209

**SAFETY OF DAMS--BUREAU OF RECLAMATION,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
For primary bibliographic entry see Field 8A.  
W75-10221

**THE DAVY JONES GARBAGE DUMP,**  
Raytheon Co., Portsmouth, R.I.  
For primary bibliographic entry see Field 5G.  
W75-10238

**CHANGING FEDERAL-STATE RELATIONSHIPS IN WATER POLLUTION CONTROL PROGRAMS,**  
Pittsburgh Univ., Pa. Health Law Program.  
For primary bibliographic entry see Field 5G.  
W75-10270

**REGULATION OF OCEAN DUMPING--ONE YEAR LATER,**  
National Wildlife Federation, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10285

**INTERNATIONAL LEGAL IMPLICATIONS OF OFF-SHORE TERMINAL FACILITIES,**  
For primary bibliographic entry see Field 5G.  
W75-10286

**OBSTACLES TO TAMING CORPORATE POLLUTERS: WATER POLLUTION POLITICS IN GARY, INDIANA,**  
Hampshire Coll. Amherst, Mass. Dept. of Political Science.  
For primary bibliographic entry see Field 5G.  
W75-10287

**APPLICATION OF NEPA TO EPA'S ENVIRONMENTAL REGULATORY ACTIVITIES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 6G.  
W75-10288

**SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 6G.  
W75-10289

**PRESERVATION AND ENHANCEMENT OF THE AMERICAN FALLS AT NIAGARA.**  
American Falls International Board, Buffalo, N.Y.  
Final Report to the International Joint Commission, June 1974. 154 p, 44 plate, 1 map, 9 tab, 1 append.

Descriptors: \*History, \*Rivers and Harbors Act, \*Waterfalls, \*International Joint Commission, \*Talus, Rivers, Harbors, Scenery, International waters, Natural use, Erosion, Erosion control, International commissions.  
Identifiers: Evidence.

Section 304 of the Rivers and Harbors Act deals with the American Falls at Niagara as a scenic spectacle of international significance and with the continuing process of change in the form and appearance of the Falls. The study concludes that the guiding policy should accept the process of change as a dynamic part of the natural condition of the Falls, and that the process of erosion and recession should not be interrupted. The American Falls International Board reported the following findings and conclusions to the International Joint Commission: that it is feasible to remove as much talus as desirable; that the appearance of the Falls cannot be studied in isolation; that the area is en-

dangered by the possibility of erosion and other geological conditions; and that measures are both feasible and desirable to protect these areas in order to eliminate any hazards to persons or property or to the scenic beauty of the region. (Gagliardi-Florida)  
W75-10290

**MINUTES OF THE 89TH MEETING, (ARKANSAS-RED-WHITE RIVER BASINS INTER-AGENCY COMMITTEE).**  
Arkansas-White-Red Basins Inter-Agency Committee, Wichita, Kans.  
For primary bibliographic entry see Field 4A.  
W75-10300

**REGIONALISM AND THE LAW OF THE SEA: THE CASE OF SEMI-ENCLOSED SEAS,**  
Rhode Island Univ., Kingston.  
L. M. Alexander.

Ocean Development and International Law, Vol 2, p 151-185 (1974). 35 p, 2 tab, 1 map, 1 append.

Descriptors: \*Geographical regions, \*Shores, \*Regions, Regulation, Gulfs, Water, Sea water, Conferences, South America, \*International law, International waters.

Identifiers: International agreements, Coastal waters.

One of the possible outcomes of the Third Law of the Sea Conference may be a recognition of the right of countries within a geographical region to establish special juridical arrangements for their offshore areas. Regions may be of two types: common policy groupings, such as the Latin American or Soviet Union/East European Socialist states blocs; or complementary-use regions, as the Caribbean, Mediterranean, or other semi-enclosed seas. The authors postulate that serious attention should be given at the conference both to the definition of regions as geographic entities and to the delineation of the types of special rules and regulations which may be adopted within these regions. A summary of the geographic and legal/political characteristics of twenty-five 'semi-enclosed seas' are presented as illustrative of a clearly defined type of complimentary-use region for which specific jurisdictional arrangements might be made. (Gagliardi-Florida)  
W75-10301

**FEDERAL VIEWPOINT (PERMIT ISSUANCE--ADMINISTRATIVE AND JUDICIAL REVIEW--OBSERVATIONS AND PROBLEMS),**  
Environmental Protection Agency, Chicago, Ill. Enforcement Div.  
For primary bibliographic entry see Field 5G.  
W75-10302

**LEGISLATION UNDER NEPA: PLAINTIFFS' PHYLIC VICTORIES DRAW CONGRESSIONAL FIRE, JUDICIAL WARNINGS,**  
For primary bibliographic entry see Field 5G.  
W75-10303

**SURFACE WATERS AND THE CIVIL LAW RULE,**  
Long and Aldridge, Atlanta, Ga.  
C. C. Long, and E. E. Long.  
Emory Law Journal, Vol 23, No 4, p 1013-1046 (1974). 24 p, 182 ref.

Descriptors: \*Surface waters, \*Cities, \*Land use, \*Adjacent land owners, \*Riparian rights, Running waters, Runoff, Surface runoff, Streams, Urban runoff, Land development, Legal aspects, Civil law, Judicial decisions, Land tenure, Riparian land, Water rights, Water law.  
Identifiers: \*Civil law rule, Common enemy rule.

Because of increasing population growth and the concentration of people in urban areas, the

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disposition of surface water has attained greater significance in the context of modern land development. The legal implications of the problem are considered, with particular focus on the application of the civil law rule of surface water in both its strictly applied and modified forms. Disturbance of the natural flow of water is prohibited under this doctrine, thus the duties of adjacent landowners are reciprocal and complementary. The rationale of the rule and various modifications of the rule in actual application by courts are discussed. Various bases for liability are surveyed in the context of remedies for the damaged plaintiff and possible defenses for the alleged wrongdoer. The authors dispute the contention that the civil law rule has inhibited land development, and conclude that the modifications of the civil law rule adequately balance conflicting interests and offer substantial predictability. (Fernandez-Florida)  
W75-10304

**THE PUBLIC TRUST DOCTRINE AND THE CALIFORNIA COASTLINE,**  
San Diego State Univ., Calif.  
M. A. Eikel, and W. S. Williams.  
The Urban Lawyer, Vol 6, No 3, p 519-571 (1974).  
53 p, 1 chart, 274 ref.

Descriptors: \*Coasts, \*Beach erosion, Natural resources, \*Legal aspects, \*Environmental control, Beaches, Littoral, Oceans, Erosion, Damages, Erosion control, Land management, Conservation, Resources, Judicial decisions, Ownership of beds, Public rights, Regulation, Riparian land, State governments, Tidal marshes, Navigable waters, \*California.

Identifiers: Coastal waters, \*Coastal zone management, \*Public trust doctrine, Environmental policy, Non-point sources(Pollution), State policy.

Man's interference with the rich and varied California coastline has resulted in beach erosion, pollution of bays and the ocean, and disruption and deterioration of the lagoon and estuarine environments. Environmental concern in the state has focused substantially on the area's coastal resources. This article considers the legal aspects of governmental involvement in preserving the coastal zone. Powers and constraints on power are discussed in the context of the 'public trust doctrine'. The authors suggest that the doctrine provides a legal tool for improving and preserving the natural environment. Generally, the public trust doctrine is based on the principle that the state holds title to tidelands and navigable waters subject to a trust with the public as beneficiary. Placing primary emphasis on California law, the paper traces the development of the doctrine and discusses the powers and duties of decision-makers who handle public trust land. (Fernandez-Florida)  
W75-10305

#### RULES AND REGULATIONS, SOUTHWEST WATER MANAGEMENT DISTRICT (FLORIDA).

Southwest Florida Water Management District, Brooksville.  
Florida Administrative Code, 16 G-4.004 thru 16 G-4.463 (1974). 122 p.

Descriptors: \*Permits, \*Water policy, \*Administrative agencies, \*Water management(Applied), \*Florida, Local governments, State governments, Groundwater, Groundwater recharge, Surface waters, Water resources, Water shortage, Water supply, Water table, Aquifers, Water wells, Water law, Water levels.  
Identifiers: \*Florida Water Resources Act of 1972, State policy.

The purpose of the Rules and Regulations of the Southwest Florida Water Management District is to implement the declared water policy of the Dis-

trict and the State of Florida by effecting maximum beneficial utilization, development, and conservation of the water resources of the District. The Rules consist of five chapters, the first of which, 16CB-0, contains the purpose of the Rules, procedures for acquiring permit application, fee schedules, and provisions for the determination of minimum flows and levels. Chapter 16CB-1 contains rules for the protection of the works in the District, which is to be accomplished by requiring permits for those who find it necessary to interfere in any manner with any of the works of the District. Chapter 16CB-2 contains a program for the issuance of permits authorizing the consumptive use of water. Chapter 16CB-3 concerns the regulation of wells and the registration of any person who constructs a water well or test or foundation held within District boundaries. Chapter 16CB-4 governs the management and storage of surface waters. Permits are required to construct, alter, abandon or remove any dam, reservoir, or impoundment. (Denvir-Florida)  
W75-10306

#### RULES OF CENTRAL AND SOUTHERN FLOOD CONTROL DISTRICT, CHAPTER 16CA, WITH COMMENTARY.

Central and Southern Florida Flood Control District, West Palm Beach.  
Florida Administrative Code, 16CA-0.01 thru 16CA-4.14 (1974). 16 p.

Descriptors: \*Permits, \*Water policy, \*Administrative agencies, \*Water management(Applied), Florida, Local governments, State governments, Groundwater, Groundwater recharge, Surface waters, Water resources, Water shortage, Water supply, Water table, Aquifers, Water wells, Water law, Water levels.  
Identifiers: \*Florida Water Resources Act of 1972, State policy.

The Rules of Central and Southern Florida Flood Control District were promulgated to effectuate its powers, duties and functions under the Florida Water Resources Act of 1972. The purpose of the regulations is to effect the maximum utilization of the waters in the District. The Rules consist of four chapters. Chapter 16CA-0 contains the scope of jurisdiction and powers and duties of the district. In addition, Chapter 16CA-0.06 sets forth activities for which permits must be sought, such as the diversion of water, construction, alteration, or abandonment of any dam or reservoir in the District, as well as any discharge into the waters of the District. Chapter 16CA-1 prescribes the procedures for filing of citizen complaints or objections, administrative enforcement procedures, quasi-judicial hearings before the governing board, and requests for hearings. Chapter 16CA-2 provides for the implementation of a permit system designed to regulate and control the use of ground and surface water within the District. Chapter 16CA-4 deals with the management and storage of surface waters in the District and the works necessary to those ends. (Denvir-Florida)  
W75-10307

#### HARDY SALT CO. V. SOUTHERN PACIFIC TRANSPORTATION CO. (SUIT SEEKING INJUNCTIVE RELIEF OR DAMAGES FOR SALINITY CHANGES RESULTING FROM DEFENDANT'S CONSTRUCTION IN THE GREAT SALT LAKE).

501 F.2d 1156 (10th Cir. 1974). 14 p.

Descriptors: \*Salinity, \*Railroads, \*Great Salt Lake, Royalties, Wastes, Navigation, \*Utah, Easements, Salts, Brines, Shrimp, Rivers, Harbors, Rivers and Harbors Act.  
Identifiers: Evidence, Injunctive relief, Nuisance(Legal aspects).

Plaintiffs brought consolidated actions seeking injunctive relief or damages for alleged injury from salinity changes resulting from defendant rail-

road's construction and operation of a causeway across the Great Salt Lake pursuant to an easement granted by the State of Utah. The United States District Court for Utah, Central Division, sustained the railroad's motion to dismiss, prompting plaintiffs' appeal. The Court of Appeals affirmed and held the plaintiffs, engaged in removing salt or brine shrimp and eggs from Great Salt Lake pursuant to royalty and license agreements with the State of Utah, failed to demonstrate the type of a business or economic interest entitling them to relief under state law for nuisance, waste, or interference with business. The court further held that proof of navigation across the lake and up the Bear River to the railhead at Corinne, Utah, was not in itself sufficient to establish that the lake was a navigable water of the United States within the Rivers and Harbors Act. (Gagliardi-Florida)  
W75-10308

**ALABAMA'S WATER RESOURCES POLICY.**  
Alabama Development Office, Montgomery.  
For primary bibliographic entry see Field 5G.  
W75-10310

#### REPORT TO THE CONGRESS ON OCEAN DUMPING AND OTHER MAN-INDUCED CHANGES TO OCEAN ECOSYSTEMS (OCTOBER 1972 THROUGH DECEMBER 1973).

National Oceanic and Atmospheric Administration, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10311

#### SMITH V. CITY OF COOKEVILLE (ACTION BY LANDOWNER WHOSE PROPERTY WAS CONDEMNED BY CITY FOR USE IN RECREATION DEVELOPMENT TO ENJOIN CONSTRUCTION UNTIL ENVIRONMENTAL IMPACT STATEMENT IS FILED).

381 F. Supp. 100 (M.D. Tenn. 1974).

Descriptors: \*Recreation facilities, \*Environmental control, \*Eminent domain, \*Tennessee, Condemnation, recreation, Environmental effects, Environment, Construction, Lakes, Ponds, Resources development, Flood protection, Adjacent landowners, Administrative agencies.

Identifiers: \*Environmental impact statement, Injunctive relief, National Environmental Policy Act, Standing(Legal).

Landowners, whose property was condemned by the City of Cookeville, Tennessee, filed suit to enjoin further construction and development of a recreation area on the ground that no environmental impact statement was filed and that they had been paid no relocation benefits. The federal district court held the landowners had standing to bring the action but were not entitled to relocation benefits which they had previously declined. In addition, the court found that the proposed project was a major federal action significantly affecting the environment requiring a formal environmental impact statement, but denied an injunction since the construction contracts had not been let but had been merely scheduled for negotiation. The court found it reasonable to permit defendants to advertise the job for bids, execute contracts and finalize bids, subject to preparation of the environmental impact statement. (Gagliardi-Florida)  
W75-10312

#### SCENIC RIVERS ASSOCIATION OF OKLAHOMA V. LYNN (SUIT SEEKING DECLARATORY JUDGMENT THAT HUD MUST MAKE AN ENVIRONMENTAL IMPACT STUDY PRIOR TO THEIR CONTEMPLATED ACTIONS).

382 F. Supp. 69 (E.D. Oklahoma 1974).

Descriptors: \*Oklahoma, \*Land development, \*Water law, \*Water quality, River basin develop-

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ment, River basins, Rivers, Southwest US, Judicial decisions, Environmental effects, Streams, Wildlife, Habitats, Aesthetics.

Identifiers: \*Environmental impact statement, \*Oklahoma, \*Illinois river basin, \*HUD, \*National Environmental Policy Act, Injunctive relief.

Plaintiffs sought a declaratory judgment that the Department of Housing and Urban Development (HUD) must conduct an environmental impact study prior to approval and registration of a statement of record and property report under the Interstate Sales Act, and sought injunctive relief requiring HUD to withdraw approval of interstate land sales filings pending an environmental review process. District Court Judge Bohanon found that plaintiffs, environmental organizations, demonstrated actual and potential environmental effects on many aspects of natural wildlife and water-related and other recreational activities if the proposed development of some 7,000 acres in Illinois river basin were to occur and that HUD's approval of documents filed under the Interstate Land Sales Act was a major federal action, significantly affecting quality of the environment. Like all other federal agencies, HUD is required under the National Environmental Policy Act of 1969 (NEPA) to consider the environmental effects of its decisions and to use all practical means to avoid environmental degradation. Here, plaintiffs had met the burden of establishing an overriding public interest in preservation of the area's character and of showing that failure to comply with NEPA procedures would create a threat of environmental injury. Thus, the court required HUD to withdraw its approval of the environmental injury. Thus, the court required HUD to withdraw its approval of the joint venture at issue in this case and also rendered its declaratory judgment that HUD conduct an environmental impact study preparatory to approval and registration of statement of record and property report under the Interstate Sales Act in all cases. (Gerlach-Florida)

W75-10313

**TON-DA-LAY, LTD. V. DIAMOND (REVIEW OF DENIAL OF APPLICATION FOR WATER SUPPLY AND SEWAGE TREATMENT SYSTEMS).**

355 N.Y.S.2d 820 (N.Y.S.C. 1974).

Descriptors: \*New York, \*Judicial decisions, \*Permits, \*Environmental control, \*Adjudication procedure, Water supply development, Waste disposal, Septic tanks, Sewage treatment, Land tenure, Administrative agencies, State governments, Legislation, Land development, Regulation, Water law, Aesthetics, Environmental effects, Sewage disposal, Water quality control, Non-structural alternatives.

Identifiers: Environmental policy, State policy.

The petitioner, a land development company, sought the approval of the New York Department of Environmental Conservation, respondent herein, concerning planned water supply and sewage treatment systems. The systems would serve a vacation home community being developed on land owned by the petitioner. The Commissioner rejected the applications and petitioner appealed to the Appellate Division of the Supreme Court of New York. The court held that the evidence supported the Commissioner's finding that the proposed water supply system did not adequately provide for proper and safe construction and for protection from contamination. The court further held, however, that the evidence did not support a finding that the proposed supply did not meet any public necessity but that the evidence did support a finding that the proposed sewage disposal system consisting of individual septic systems would pollute area lakes. While pointing out that it is not within the Department's power to reject petitioner's water and sewer proposal based on the aesthetic and ecological undesirability of the entire development project, the

court confirmed the Commissioner's ruling, as modified. (Deckert-Florida)

W75-10314

**SUTHERLAND V. HICKORY NUT CORP. (ACTION FOR DAMAGES CAUSED BY CONSTRUCTION OF ROADS BY ADJACENT PROPERTY OWNER WHICH ALTERED NATURAL DRAINAGE OF MOUNTAIN LAND).**

209 S.E.2d 301-305 (Ct. App. N.C. 1974).

Descriptors: \*Adjacent landowners, \*Judicial decisions, \*Natural flow doctrine, \*Obstruction to flow, Natural streams, Watercourses(Legal aspects), Legal aspects, Civil law, Common law, Land tenure, Riparian land, Water law, Water rights, Relative rights, Riparian rights, Alteration of flow, Reasonable use, Natural use, Drainage, Running waters, Land subsidence, \*North Carolina.

Identifiers: \*Liability(Legal aspects).

Plaintiff sued for damages incurred on his property by defendant's construction of roads on adjacent land resulting in alteration of the natural drainage of surface waters causing mud and silt to stop a drain and damage plaintiff's house and property. Defendant contended that the road did not alter the natural drainage of the water or change its path and that the road was built in conformity with engineering plans. The court followed the 'Civil-Law Rule', which recognizes a natural servitude of natural drainage between adjoining lands, so that the lower owner must accept the surface water which naturally drains into his land. On the other hand, the upper owner cannot change the natural drainage in a manner which would increase the natural burden. The court held that the lower landowner was not required to receive from higher land materials which in the natural condition of the lands would not be carried by the normal flow of surface waters. (Fernandez-Florida)

W75-10315

**DUPONT DE NEMOURS AND CO. V. TRAIN (ACTION BY CHEMICAL MANUFACTURERS TO SET ASIDE REGULATIONS GOVERNING EFFLUENT DISCHARGE OF SULFURIC ACID PLANTS).**

383 F. Supp. 1244-1256 (W.D. Va. 1974).

Descriptors: \*Judicial decisions, \*Legal review, \*Regulation, \*Administrative agencies, \*Effluents, Wastes, Discharge(Water), Legal aspects, Constitutional law, Jurisdiction, Industrial wastes, Federal jurisdiction, Water law, Administration, Legislation, Federal Water Pollution Control Act, Water Quality Act, Federal government, Water pollution sources, Water pollution.

Identifiers: Administrative regulation, \*Federal Water Pollution Control Act Amendments of 1972, Injunctive relief, Effluent limitations, Hazardous substances(Pollution).

An action was brought by chemical manufacturers for declaratory and injunctive relief against the Administrator of the Environmental Protection Agency (EPA), seeking to set aside regulations promulgated by the Administrator governing the effluent discharge of sulfuric acid plants, on grounds that the regulations were arbitrary, capricious, not supported by substantial evidence, beyond the authority of the EPA, and not in accord with procedures of the Federal Water Pollution Control Act Amendments of 1972. Three issues were before the court: (1) whether the Administrator has authority under section 301(b) of the Act to issue regulations establishing effluent limitations for sulfuric acid plants; (2) whether the regulations in question conform to section 304(b) of the Act and the notice and public participation provisions of the Administrative Procedure Act; and (3) whether the district court had jurisdiction to review the regulations in question and the procedures by which they were promulgated. The court concluded: (1) that the Administrator was

authorized to promulgate by regulation the effluent limitation in issue; (2) that the structural and content requirements of such regulations under section 304(b) were satisfied; and (3) that judicial review of these limitations and guidelines is vested exclusively in the Court of Appeals. Thus, the court dismissed the action for lack of subject matter jurisdiction. (Fernandez-Florida)

W75-10316

**UNITED STATES V. ST. THOMAS BEACH RESORTS, INC. (ACTION TO ENJOIN OBSTRUCTION TO VIRGIN ISLANDS SHORELINE BY FENCES SEWARD OF THE MEAN HIGH WATER LINE).**

386 F. Supp. 769-774 (D.C. V.I. 1974).

Descriptors: \*Virgin Islands, \*Seashores, \*Trespass, \*Public access, \*Public rights, Judicial decisions, Constitutional law, Common law, Shores, Beaches, Boundaries(Property), Coastal structures, Legal aspects, Easements, Riparian rights, Equity, Land tenure, Water law, United States, Federal government, Legislation.

Identifiers: \*Injunctive relief, Water rights(Non-riparians).

Plaintiff, United States, sought to enjoin the obstruction of the Virgin Islands shoreline. Defendant, beach resort, had erected chain link and barbwire fences which traversed the beach area. Plaintiff alleged that the inland extension of the fences, obstructing the shoreline, violated the Virgin Islands Open Shorelines Act and contravenes rights or property acquired by the United States by purchase of the islands from the Kingdom of Denmark. Defendant argued that the Open Shorelines Act was unconstitutionally vague and uncertain and that it is in violation of the Revised Organic Act of 1954, which makes impermissible the taking of property without just compensation. The court held that the applicable provisions of the Open Shorelands Act were not void for vagueness and did not amount of a taking of property from abutting landowners without just compensation. In granting that injunction, the court further held that the erection of fences seaward of the mean high tide mark and the extending of fences inland constituted a trespass upon property belonging to the United States and a manifest interference with the right of the public to enjoy the shoreline. (Fernandez-Florida)

W75-10317

#### OCEAN POLLUTION.

For primary bibliographic entry see Field 5G.  
W75-10318

**MOUNTAIN PARK RECLAMATION PROJECT, OKLAHOMA—NUECCES RIVER PROJECT, TEXAS.**

For primary bibliographic entry see Field 4A.  
W75-10319

**CHATTahoochee RIVER NATIONAL RECREATION AREA, GEORGIA.**

For primary bibliographic entry see Field 6G.  
W75-10320

**THE IMPACT OF SECONDARY TREATMENT ON WASTES DISCHARGED INTO THE OCEAN.**

For primary bibliographic entry see Field 5D.  
W75-10321

**IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT.**

For primary bibliographic entry see Field 5G.  
W75-10322

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

**STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY—PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR INCOMPATIBLE POLLUTANTS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10323

**MARINE SANITATION DEVICES—PROPOSED CERTIFICATION PROCEDURES AND DESIGN AND CONSTRUCTION REQUIREMENTS.**  
Coast Guard, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10324

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10325

**LIQUID AND CRYSTALLINE CANE SUGAR REFINING SUBCATEGORY—EFFLUENT LIMITATIONS GUIDELINES AND PROPOSED PRETREATMENT STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10326

**INORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10327

**ELECTROPLATING POINT SOURCE CATEGORY; COPPER, NICKEL, CHROMIUM AND ZINC ON FERROUS AND NONFERROUS MATERIALS SUBCATEGORY.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10328

**THERMAL DISCHARGES—PROPOSED PROCEDURES FOR THE IMPOSITION OF ALTERNATIVE EFFLUENT LIMITATIONS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10329

**ASBESTOS MANUFACTURING POINT SOURCE CATEGORY—EFFLUENT LIMITATIONS GUIDELINES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10330

**FERROALLOY MANUFACTURING POINT SOURCE CATEGORY.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10332

**FEEDLOTS POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10333

**GLASS MANUFACTURING POINT SOURCE CATEGORIES—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10334

**THERMAL DISCHARGES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10335

**BUILDERS PAPER AND BOARD MANUFACTURING POINT SOURCE CATEGORY—EFFLUENT LIMITATIONS GUIDELINES.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10336

**STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY—EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10337

### 6F. Nonstructural Alternatives

**PROCEEDINGS OF WORKSHOP CONFERENCE ON IDENTIFICATION OF METROPOLITAN AREA WATER RESOURCES PROBLEMS AND ASSOCIATED RESEARCH NEEDS IN MINNESOTA.**  
Minnesota Univ., St. Paul. Water Resources Research Center.  
For primary bibliographic entry see Field 6B.  
W75-10004

**APPLICATIONS OF INTEGER AND QUADRATIC PROGRAMMING TO FLOODPLAIN LAND USE MANAGEMENT,**  
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.  
J. L. Kaul, and C. E. Willis.  
Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 773, \$3.75 in paper copy, \$2.25 in microfiche. Paper presented to Operations Research Society, San Juan, Puerto Rico, October 17, 1974. 38 p. 2 fig. 6 tab. 33 ref. OWRT B-043-MASS(1). 14-31-000-3896.

Descriptors: Flood control, \*Land use, \*Flood plain zoning, Decision making, Non-structural alternatives, Economic efficiency, Methodology, Mathematical models, Algorithms, Connecticut River, Risks, Management, Programming languages.  
Identifiers: \*Quadratic programming, \*Integer programming, \*Connecticut River basin.

Methodologies useful to planners at several levels for efficiently managing floodplains using both structural and non-structural measures are provided. The usefulness of these frameworks is demonstrated by applying them to a selected floodplain in the Connecticut River Basin. The algorithms for solving these two decision frameworks employ, respectively, integer and quadratic programming procedures. These frameworks enable the formulation of far more realistic and interesting situations than either of the only two previous applications of operations research methods (both linear programming applications). Major advantages of these two frameworks are that they are cast in a stochastic rather than a deterministic mode (hence enabling the capture of important effects of risk and uncer-

tainty) and presume the demand for land in various uses to be price flexible. The decision framework considers floodplain zoning, flood proofing, and other structural alternatives as well as enabling the incorporation of external effects of floodplain development on communities upstream and downstream.  
W75-10008

### 6G. Ecologic Impact Of Water Development

**QUANTITATIVE ERROR ANALYSIS OF NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS,**  
Rutgers - the State Univ., New Brunswick, N.J. Dept. of Computer Science.  
V. Vichnevetsky, K. W. Tu, and J. A. Steen.  
Available from the National Technical Information Service, Springfield, Va 22161 as PB-243 912, \$3.25 in paper copy, \$2.25 in microfiche. Interdepartmental Report DCS-TR-No 28. 5 p, 7 fig, 2 ref, March 1974. (Reprinted from Proceedings of 8th Annual Princeton Conference on Information Science and Systems, Princeton University, March 1974). OWRT B-045-NJ(2), B-049-NJ(2).

Descriptors: \*Approximation method, Computer models, \*Model studies, \*Numerical analysis, Systems analysis, Water quality, Estuarine environment, Equations.

Identifiers: \*Partial differential equations, \*Error analysis.

The principle of independence for small numerical errors is used to analyze global errors for certain classes of partial differential equations which arise in quality analysis for estuarial systems. (Davidson-New Jersey)  
W75-10003

**WASTING A RIVER,**  
California Univ., Berkeley. Coll. of Natural Resources.  
For primary bibliographic entry see Field 6B.  
W75-10116

**PROCEDURE FOR EVALUATING ENVIRONMENTAL IMPACT,**  
Geological Survey, Washington, D.C.  
G. H. Davis.  
In: Proceedings of Workshop Environmental Impact Statements, Florida Technological University, Orlando, June 1973: Florida Technological University Publication, p 37-44, 1973. 3 fig, 4 ref.

Descriptors: \*Environmental effects, Project planning, Planning, Water management(Applied), Federal government, Evaluation.  
Identifiers: \*Environmental impact.

A procedure that provides a numerical scale of environmental impacts for the use of decision makers in choosing among various program alternatives is reviewed. The matrix technique described in Geological Survey Circular 645 has proven valuable as a checklist for those involved in developing impact statements, and has proven acceptable to the courts as a device for subdividing and analyzing numerically the impacts of a given program. (Knapp-USGS)  
W75-10164

**EFFECTS OF FIRE ON THE PLANTS AND ANIMALS OF A FLORIDA WETLAND,**  
California State Univ., Los Angeles. Dept. of Biology.  
R. J. Vogl.  
Am Midland Nat. Vol 89, No 2, p 334-347, 1973, Illus.  
Identifiers: Alligator, Bird, \*Burning, \*Controlled fire, \*Florida, Mammals, \*Wetlands, Aquatic animals.

**WATER RESOURCES PLANNING—Field 6**  
**Ecologic Impact Of Water Development—Group 6G**

A total of 754 birds were recorded on a portion of a Florida pond shore line during 63 visits for 4 mo. following a controlled burn, while 236 birds were observed on an adjacent and comparable, but unburned, shore line. Only 5 of the 35 bird species encountered were seen more often on the unburned site. Fire-induced bird and mammal injury or mortality was unobserved even though the burn resembled a wildfire. Birds showed no fear of the fire and some were attracted to the smoking landscape. Although some cold-blooded vertebrate mortality occurred, other herptiles survived, and alligators used the burned shore line almost exclusively. Mammal populations of burned and unburned areas appeared similar 4 mo. after the fire. Animal responses are considered related to the fire removal of the heavy grass mat that otherwise covered the water and soils and the foods contained therein, and physically impaired new plant growth. Burning also produced an earlier, more rapid and far more productive growth of wet-prairie plants.—Copyright 1973, Biological Abstracts, Inc.  
W75-10181

**INTERNATIONAL CONFERENCE ON THE CONSERVATION OF WETLANDS AND WATERFOWL.**

Meeting held at Ramsar, Iran, 30, Jan 3, Feb 1971. 303 p., Illus International Wildfowl Research Bureau: Slimbridge (Glos), England, 1972. Carp, E (ed).

Identifiers: \*Conferences, \*Conservation, International meetings, Pesticides, Pollution, \*Waterfowl, \*Wetlands.

This book sets out the text of the Final Act of the Conference and contains a summary record of its proceedings. The need for wetlands convention was felt in 1962 at the International Conference on Wetlands held in France. There, it was decided that a list should be compiled of European and North African wetlands of international importance. This final text of the convention is therefore the result of 9 yr of careful study and international cooperation among scientific and legal experts of a great number of countries, and several international organizations. The conference adopted 11 recommendations for consideration and appropriate action involving the following topics: conservation of the Wadden Sea, northwestern Europe; conservation of Thjorsarvar, Iceland; conservation of North Bull Island, Ireland; conservation of Lakes Ab-i-Istada and Dasht-e-Nawar, Afghanistan; conservation of the Medway Estuary, England; oil pollution; pesticides; promotion of wetlands research; promotion of hunting research and education; African wetlands; wetlands and the Man and the Biosphere Program. The book will be of interest to individuals and agencies involved in the conservation of wetlands.—Copyright 1973, Biological Abstracts, Inc.  
W75-10198

**ISSUES IN WATER RESOURCES IMPACT ASSESSMENT,**  
Stanford Univ., Calif. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6B.  
W75-10222

**APPLICATION OF NEPA TO EPA'S ENVIRONMENTAL REGULATORY ACTIVITIES.**  
Environmental Protection Agency, Washington, D.C.  
Available from the National Technical Information Service, Springfield, Va 22161, U.S.D.C., as PB-231 158, \$4.75 in paper copy, \$2.25 in microfiche. February 1973, 84 p.

Descriptors: \*Environmental control, \*Environmental effects, \*Regulation, Environment, Air pollution, Pesticides, Wastes, Solid wastes, Radiation, Administrative agencies, Administrative decisions.

Identifiers: \*Environmental impact statement, Administrative regulations, \*National Environmental Policy Act.

The National Environmental Policy Act of 1969 (NEPA) requires all agencies of the federal government to prepare, in connection with all major federal actions significantly affecting the quality of the human environment, detailed environmental impact statements. However, such statements have not been prepared for environmental protective regulatory activities taken or concurred in by the Environmental Protection Agency (EPA). The Task Force which investigated the situation concluded that the EPA is entitled to maintain its permit position that NEPA does not legally apply to its regulatory programs. The Task Force reasoned that the application of NEPA to EPA programs would disrupt the agency's operations, and that the benefits to be gained by applying NEPA would not outweigh the significant harm caused by such disruption. The Task Force suggested that courts are likely to be able to resolve the issue in the most efficacious manner. It was the Task Force's recommendation that the Agency pursue a judicial determination that NEPA does not legally apply to its regulatory problems. (Gagliardi-Florida)  
W75-10288

**SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS.**

Environmental Protection Agency, Washington, D.C.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-233 430, \$3.25 in paper copy, \$2.25 in microfiche. No. 9, May 1973, 16 p.

Descriptors: \*Publications, \*Data collections, \*Foreign countries, \*Foreign research, Governments, Foreign projects, Data processing, Computers, Data storage and retrieval, Information exchange, Investigations, Translations, Information retrieval.

Identifiers: International agreements.

Pursuant to documents exchange agreements with environmental agencies of other countries, the Environmental Protection Agency (EPA) is building an international collection of environmental reports. This is the ninth in a series of announcements of foreign documents received. A computerized search system is being developed which will allow future retrieval of these summaries by country, subject area, and type of document. This series, which is devoted to summaries of government reports and focuses on legislative, economic and social aspects, supplements foreign scientific and technical literature abstracts covered by other EPA information services. Ultimately, the EPA plans to assemble a major collection of foreign government environmental documents and to develop several approaches to the dissemination of the information to EPA staff. These announcements contain brief English abstracts of the listed documents. The original documents may be obtained through the library Systems Branch. More detailed English abstracts and full text translations are also available. (Proctor-Florida)  
W75-10289

**PROPOSED 1973 OUTER CONTINENTAL SHELF OIL AND GAS GENERAL LEASE-SELL, OFFSHORE MISSISSIPPI, ALABAMA, AND FLORIDA, VOLUME 3, ALTERNATIVES TO THE PROPOSED ACTION (FINAL ENVIRONMENTAL IMPACT STATEMENT).**

Bureau of Land Management, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10291

**AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Bureau of Reclamation, Washington, D.C.

For primary bibliographic entry see Field 8A.  
W75-10292

**BIG HILL LAKE CREEK, KANSAS (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineer District, Tulsa, Okla.  
For primary bibliographic entry see Field 8D.  
W75-10293

**TYBEE ISLAND GEORGIA, BEACH EROSION CONTROL PROJECT (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4D.  
W75-10294

**TRED AVON RIVER, TALBOT COUNTY, MARYLAND (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineering District, Baltimore, Md.  
For primary bibliographic entry see Field 4A.  
W75-10295

**INITIAL STAGE, GARRISON DIVERSION UNIT, PICK-SLOAN MISSOURI BASIN PROGRAM, NORTH DAKOTA (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Bureau of Reclamation, Billings, Mont. Upper Missouri Region.  
For primary bibliographic entry see Field 8A.  
W75-10296

**CLAYTON LAKE, JACK FORK CREEK, OKLAHOMA (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineer District, Tulsa, Okla.  
For primary bibliographic entry see Field 8A.  
W75-10297

**WARM SPRINGS DAM AND LAKE SONOMA PROJECT, RUSSIAN RIVER BASIN, SONOMA COUNTY, CALIFORNIA, PART I (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineer District, San Francisco, Calif.  
For primary bibliographic entry see Field 8A.  
W75-10298

**WARM SPRINGS DAM AND LAKE SONOMA PROJECT, RUSSIAN RIVER BASIN, SONOMA COUNTY, CALIFORNIA, PART II (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Army Engineer District, San Francisco, Calif.  
For primary bibliographic entry see Field 8A.  
W75-10299

**LEGISLATION UNDER NEPA: PLAINTIFFS' PYRRHIC VICTORIES DRAW CONGRESSIONAL FIRE, JUDICIAL WARNINGS,**  
For primary bibliographic entry see Field 5G.  
W75-10303

**SIERRA CLUB V. LYNN (ACTION FOR DECLARATORY AND INJUNCTIVE RELIEF WITH RESPECT TO DEVELOPMENT OF NEW HOUSING DEVELOPMENT).**  
502 F.2d 43 (5th Cir. 1974).

Descriptors: \*Environmental effects, \*Environmental control, \*Water pollution, Surface ground water relationships, Water pollution control, \*Texas, Environment, Water pollution treatment, Water pollution effects, Groundwater movement, Groundwater, Surface waters, Aquifers.

Identifiers: \*Environmental impact statement, Evidence, Injunctive relief.

Citizens groups brought action for declaratory and injunctive relief with respect to development of a

## Field 6—WATER RESOURCES PLANNING

### Group 6G—Ecologic Impact Of Water Development

new community under a housing and urban development program. The United States District Court for the Western District of Texas denied the relief sought and entered judgment for the defendants, concluding that the Department of Housing and Urban Development (HUD) had satisfactorily complied with all relevant statutes. Furthermore, the court resolved to retain jurisdiction over the lawsuit for so long as might be necessary to ensure that the proposed environmental safeguards were fully instituted and implemented. The Fifth Circuit Court of Appeals held that the Secretary of HUD acted neither arbitrarily nor capriciously, nor failed to act in accordance with law when he granted developers of the new community federal assistance under the Urban Growth and New Community Development Act; that the environmental impact statement filed by HUD was sufficient; that plaintiffs failed to state claims under the Water Pollution Prevention and Control Act; that in absence of proof that the developer controlled the government agency's actions or caused its default, it could not be cast in judgment for attorney fees; and that as there remained no unadjudicated claim upon which relief could be granted, the trial court had improperly retained jurisdiction. (Gagliardi-Florida) W75-10320

**REPORT TO THE CONGRESS ON OCEAN DUMPING AND OTHER MAN-INDUCED CHANGES TO OCEAN ECOSYSTEMS (OCTOBER 1972 THROUGH DECEMBER 1973).**  
National Oceanic and Atmospheric Administration, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W75-10311

**SMITH V. CITY OF COOKEVILLE (ACTION BY LANDOWNER WHOSE PROPERTY WAS CONDEMNED BY CITY FOR USE IN RECREATION DEVELOPMENT TO ENJOIN CONSTRUCTION UNTIL ENVIRONMENTAL IMPACT STATEMENT IS FILED).**  
For primary bibliographic entry see Field 6E.  
W75-10312

**OCEAN POLLUTION.**  
For primary bibliographic entry see Field 5G.  
W75-10318

**CHATTahoochee RIVER NATIONAL RECREATION AREA, GEORGIA.**  
Hearing—Subcomm. on Parks and Recreation—Comm. on Interior and Insular Affairs U.S. Senate, 93d Cong., 2d Sess., October 29, 1974. 104 p.

Descriptors: \*National parks, \*National recreation areas, \*National historic parks, \*National historic sites, \*Recreation, Natural resources, Water resources, Water supply, Scenery, \*Georgia, Federal government, Administrative agencies, Federal reservations, Public lands, Conservation, Aesthetics, Parks, History, Education, Water pollution control, Water quality control, Legislation.  
Identifiers: \*Congressional hearings, Environmental policy, Nonpoint sources(Pollution), \*Chattahoochee River area(Geo).

Hearings were held before the Senate Subcommittee on Parks and Recreation regarding S.1738, which is a bill to authorize the establishment of the Chattahoochee River National Recreation Area in the State of Georgia. The purpose of the legislation is to preserve and protect the natural, scenic, recreational, and historic values of a 48 mile segment of the Chattahoochee River from developments and uses which would substantially impair or destroy them. Emphasis was placed on the special importance of this legislation to the City of Atlanta. In addition to the natural, scenic, historic, educational, and recreational values to the Nation

as a whole, this unpolluted segment of the river is the principal water supply for metro Atlanta. Further, it was stressed that additional parkland and open space is critically needed in the rapidly growing metro area. Opinion was expressed that few metropolitan centers have such a major natural resource which can still be preserved and protected from unplanned development. Additional testimony explained the corridor's values in detail. (Fernandez-Florida) W75-10320

**AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH APPENDIX A (FINAL ENVIRONMENTAL IMPACT STATEMENT).**  
Bureau of Reclamation, Washington, D.C.  
For primary bibliographic entry see Field 8A.  
W75-10331

**PAMLICO RIVER ESTUARY—PAST, PRESENT AND FUTURE,**  
North Carolina State Univ., Raleigh. Dept. of Zoology.  
For primary bibliographic entry see Field 2L.  
W75-10338

**THE COMPARISON OF THE ENVIRONMENTAL ASPECTS OF NUCLEAR AND FOSSIL FUELLED POWER STATIONS,**  
New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.  
For primary bibliographic entry see Field 8C.  
W75-10349

## 7. RESOURCES DATA

### 7A. Network Design

**AN ICE NUCLEI CONCENTRATION BENCHMARK NETWORK,**  
National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.  
P. A. Allee.

In: *Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR), WMO No 399, Geneva (Switzerland), p 499-506, 1974. 4 fig, 7 ref.*

Descriptors: \*Networks, \*Measurement, \*Nucleation, \*United States, Southwest US, Ice, Distribution, Pacific Northwest US, Pacific Ocean, On-site data collections, Equipment, Filters, Atmospheric physics, Meteorology.  
Identifiers: \*Ice nuclei, Ice nuclei concentrations.

An ice nuclei concentration benchmark network was established in the western United States by the National Oceanic and Atmospheric Administration. The purpose of the network is to determine the climatological mean and variation for the ice nuclei concentration throughout the 17 westernmost states and the north Pacific Ocean. The network consists of field monitors located at 19 National Weather Service locations selected as most likely to be free from anthropogenic sources of ice nuclei. The instrumentation of the network consists of two parts: (1) the equipment for collecting ice nuclei at the field monitoring site, and (2) an NCAR Ice Nucleus Analyzer for the activation and counting of ice nuclei particles on the membrane filter. The data accumulated during May, June, and July 1973 were analyzed. The ice nuclei concentration was partially analyzed on both a daily and a monthly summary basis. No strong correlations between the daily ice nuclei concentration and local meteorological elements were found. No evidence of 'ice nucleus storms' progressing across the network was detected, as previously shown to exist over the north Pacific

Ocean. Monthly ice nuclei concentration averages at the network stations showed a monotonic increase when related to the distance of the station from the seashore, which can be interpreted that the earth's surface is a source of ice nuclei. Monthly ice nuclei concentration averages at the network stations increased during May, June, and July 1973. (See also W75-09944) (Sims-ISWS) W75-09999

**SEAGRASS ECOSYSTEMS. RECOMMENDATIONS FOR RESEARCH PROGRAMS.**  
For primary bibliographic entry see Field 2L.  
W75-10106

**PRODUCTIVITY/PHYSIOLOGY WORKING GROUP,**  
Texas Univ. at Austin. Dept. of Botany.  
For primary bibliographic entry see Field 2L.  
W75-10107

**SYSTEMATIC ECOLOGY WORKING GROUP,**  
Nijmegen Univ. (Netherlands). Lab. of Aquatic Ecology.  
C. den Hartog.

In: 'Seagrass Ecosystems. Recommendations for Research Programs,' *Proceedings of the International Seagrass Workshop, October 22-26, 1973, Leiden, The Netherlands, p 15-22. 1 ref.*

Descriptors: \*Marine plants, \*Grasses, \*Ecosystems, \*Life cycles, Biological communities, Resistance, Vegetation establishment, Plant growth, Revegetation, Coasts, Environmental effects, Oceans, Plant groupings, Investigations, Phenology, Productivity, Water pollution effects, Speciation, Ecotypes, Data collections, Distribution patterns, Ecological distribution.  
Identifiers: \*Seagrass, Eelgrass, International Seagrass Workshop.

The Systematic Ecology Working Group discussed topics regarding the taxonomic and ecological research needs of seagrass populations, communities, and ecosystems. The focus was on the necessity for studies both in the field and laboratory on the life cycle of seagrasses, their tolerance to environmental factors and pollutants, and establishing their potential as well as actual ecological range. Recolonization by transplanting techniques for stock replenishment, lost due to pollution, disease, or natural phenomena, or for creating new seagrass areas. Syneiology based on a wide variety of characters and community structure. Distribution of seagrass or the factors responsible for observed distribution patterns; and the need for additional taxonomic information as to the species and intraspecific level. Strategies are proposed for research in each area and recommendations are made for investigative techniques. (See also W75-10106) (Auen-Wisconsin) W75-10108

**DECOMPOSITION WORKING GROUP,**  
Aarhus Univ. (Denmark). Lab. of Ecology.  
For primary bibliographic entry see Field 2L.  
W75-10109

**CONSUMER ECOLOGY WORKING GROUP,**  
Amakusa Marine Biological Lab., Tomioka (Japan).  
For primary bibliographic entry see Field 2L.  
W75-10110

**OCEANOGRAPHY,**  
Alaska Univ., College. Inst. of Marine Science.  
For primary bibliographic entry see Field 2L.  
W75-10111

## RESOURCES DATA—Field 7

### Data Acquisition—Group 7B

**THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN)—SOME QUESTIONS AND ANSWERS,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 5A.  
W75-10168

**BIOLOGICAL WASTEWATER TREATMENT MODEL BUILDING FITS AND MISFITS,**  
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 5D.  
W75-10169

**STATISTICAL EVALUATION OF REAERATION PREDICTION EQUATIONS,**  
Tufts Univ., Medford, Mass. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W75-10211

**DIGITAL PROGRAM FOR WATER NETWORK ANALYSIS,**  
Water Research Association, Marlow(England).  
Economics Group.  
For primary bibliographic entry see Field 7C.  
W75-10220

**WATERWAY MONITORING SYSTEM.**  
Mechanical Engineering, Vol 96, No 8, p 52-53, August 1974. 1 fig.

Descriptors: \*Computers, \*Monitoring, \*Control systems, \*Water management(Applied), Mathematical models, Rivers, Canals, Inflow, Tidal flow, Oxidation-reduction potential, Conductivity, Chemical oxygen demand, Turbidity, Solar radiation.  
Identifiers: \*Waterway monitoring systems, Siemens 305 process computer, \*Belgium.

In Belgium the first computerized waterway network monitoring system in Europe began operation. It is an electronic installation, utilizing a Siemens 305 process computer, and is to be further developed to surpass pure monitoring functions and to calculate in advance the levels in locks and dams to automatically ensure efficient water distribution for all rivers and canals in Belgium. The completed installation is expected to cost 25 to 30 million DM. Presently, 240 level-measuring stations are connected by an electronic remote-control system to make up the waterways installation. Information is transmitted by a Z 701 time-division multiplex remote supervisory control system operating by pulse-code modulation. The amount of water in the rivers and canals and the different discharges and outflows can be monitored continually. A mathematical model will work in conjunction with the process computer so as to control the dams in the rivers for flood prevention during high water, and shortage during low water. The influence of precipitation in the model of the dynamic river behavior will help to forecast and control dams. At Roselies on the Sambre qualitative studies are planned for an environmental instrument station, measuring water temperature, conductivity corresponding to salt content, pH value, redox potential, COD value (chemical oxygen demand), turbidity, and solar irradiation. (Leibowitz-FIRL)  
W75-10248

**MONITORING THE QUALITY OF SURFACE WATER,**  
Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands).  
For primary bibliographic entry see Field 5A.  
W75-10251

**MONITORING: AN ENVIRONMENTAL STATE ESTIMATION PROBLEM,**  
California Univ., Davis. Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 5A.  
W75-10255

### 7B. Data Acquisition

**FREE-GRAB DEVICE FOR COLLECTING UNDERWATER SAMPLES,**  
Le Nickel S.A., Paris (France); and Centre National pour l'Exploitation des Oceans, Paris (France). (assignee).

A. Rossfelder.  
U.S Patent No 3,885,440, 4 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 934, No 4, p 1392, May 27, 1975.

Descriptors: \*Patents, \*Sampling, \*Underwater, Bottom sampling, Equipment.  
Identifiers: Free-grab sampling device.

A free-grab device is described for collecting underwater samples, particularly poly-metallic nodules deposited on ocean beds, sometimes at very great depths which may be as much as 6,000 meters. The term 'free-grab device' is used to designate sampling equipment which, in contrast to dredges, is released at the surface of the water without being connected to a ship or to a fixed surface installation. The device is caused to sink by a ballast which overcomes the action of one or more floats. When the device touches the sea-bed it releases the ballast automatically and, under float action, rises to the sea surface where it is recovered and where the samples contained are removed. The device is comprised of a box-like frame, the bottom and two sides faces of which are covered at least partially by a orificed wall, the other side faces being uncovered. Two similar pick-up jaws which are fitted with scraping blades are pivoted on the frame. In the open position they extend generally towards one another and in closed position they are in effective engagement with the uncovered side faces of the frame. Locking means lock the jaws in open position and release means acting on the locking means free the jaws when the device touches the sea-bed. (Sinha-OEIS)  
W75-09866

**THE ACQUISITION OF INFORMATION DURING ATTEMPTS AT WEATHER MODIFICATION,**  
Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.

W. D. Scott.  
In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR). WMO No 399, Geneva (Switzerland), p 353-362, 1974. 4 fig, 1 tab, 6 ref.

Descriptors: \*Weather modification, \*Measurement, \*Data collections, \*Cloud seeding, Instrumentation, Radar, Clouds, Sampling, On-site investigations, Model studies, Cloud physics, Meteorology.  
Identifiers: Airborne instrumentation.

Unfortunately, in most of the weather modification projects underway, resource limitations are such that little information is available regarding the specifics of the seeding effort. The seeding proceeds, nonetheless, with the hope that the result will be beneficial. It is disquieting that we have accepted such an attitude which stems from the belief that weather modification is truly operational. The general lack of progress in the measurement of cloud elements may be a reflection of this attitude. If a weather modification effort is to have a high probability of success, it must be able to acquire appropriate information and use it for

project planning. This information must include variations in sensitive parameters and be statistically significant. It is apparent that most of the present instruments utilize direct sampling techniques and must be supplemented or replaced by instruments which employ remote sensing techniques. (See also W75-09944) (Sims-ISWS)  
W75-09966

**DETERMINATION OF MOLECULAR HYDROGEN SULFIDE,**  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
For primary bibliographic entry see Field 5A.  
W75-10025

**A NEW INFRARED INSTRUMENT FOR MONITORING OIL FILMS ON WATER,**  
Wright and Wright, Inc., Newton Center, Mass.  
For primary bibliographic entry see Field 5A.  
W75-10044

**AN EXPERIMENTAL STUDY OF THE DETECTION OF ICE NUCLEI ON MEMBRANE FILTERS AND OTHER SUBSTRATA,**  
National Center for Atmospheric Research, Boulder, Colo.  
For primary bibliographic entry see Field 2B.  
W75-10052

**EQUIVALENT BLACKBODY TEMPERATURE OF THE TOP OF A SEVERE STORM,**  
Lyndon B. Johnson Space Center. National Aeronautics and Space Administration, Houston, Tex.  
For primary bibliographic entry see Field 2B.  
W75-10054

**EVALUATION OF AN ERTS-1 DATA COLLECTION PLATFORM INSTALLED IN THE ALPINE TUNDRA, COLORADO,**  
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.  
R. G. Barry, and J. M. Clark.  
Journal of Applied Meteorology, Vol 14, No 4, p 622-626, June 1975. 2 fig, 2 tab, 3 ref. NASA Contract NAS 5-21880.

Descriptors: \*Meteorological data, \*Remote sensing, \*Mountains, \*Colorado, Instrumentation, Weather data, Measurement, Satellites(Artificial), Rain gages, Anemometers, Data transmission, Meteorology, Evaluation.  
Identifiers: \*ERTS-1.

An ERTS-1 Data Collection Platform instrumented with meteorological sensors has been operated for more than a year at 3536 m in the Front Range, Colorado. The interface system and sensor performance were shown to operate well, although the message interval is suitable only for certain types of parameters with the present interface system. (Sims-ISWS)  
W75-10055

**MEASUREMENT OF SMALL DISCHARGES THROUGH V-NOTCH WEIRS,**  
Leupold and Stevens, Inc., Beaverton, Oreg.  
For primary bibliographic entry see Field 8B.  
W75-10059

**REMOTE DETECTION OF POLLUTION OF WATER RESERVOIRS AND PHYTOPLANKTON BY OPTICAL METHODS,**  
K. A. Kondratyev, A. A. Buznikov, and D. V. Pozdnyakov.  
Available from the National Technical Information Service, Springfield, Va 22161 as N74-19970, \$3.25 in paper copy, \$2.25 in microfiche. NASA Technical Translation F-14,767, March 1974. 19 p, 3 fig, 19 ref. Translated from Vodnye Resursy, No 3, p 65-74, 1972.

## Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

Descriptors: \*Remote sensing, \*Water pollution, \*Phytoplankton, \*Oil pollution, Electromagnetic waves, Infrared radiation, Fluorescence, Oceans, Freshwater, Tracking techniques, Spectrophotometry.  
Identifiers: Laser.

A review of data shows that remote detection of oil films and phytoplankton can be conducted by optical methods as the refractive index of oil is higher than the refractive index of water. In the infrared range, higher values of the reflection coefficient from a surface covered by oil must be expected. A catalogue of the optical properties of oil types and petroleum products in various stages of transformation, to which they are subjected in natural conditions, could be made. The stable correlations between the thickness of an oil layer, its composition and optical contrast in different lighting conditions and the state of the sea surface must be studied. It is important to carry out simultaneous complex measurements in various regions of the electromagnetic spectrum, the results of which could complement each other, and also to carry out independent, direct measurement of the investigated parameters. These methods can be used for detecting oil deposits and also for the search for shoals of fish indicated by increased concentration of phytoplankton. Results showed that the fluorescence method can be used successfully, if a powerful laser is used as an active locator. (Jones-Wisconsin)  
W75-10098

**UTILIZATION OF AERIAL PHOTOGRAPHS FOR MEASURING LAND USE CHANGES IN WATERSHEDS,**  
Clemson Univ., S.C. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 4C.  
W75-10136

**THE MAGNETIC FLOWMETER AND ITS USE IN WASTE WATER TECHNOLOGY (DER MAGNETISCHE DURCHFLUSSMESSER UND SEINE ANWENDUNG IN DER ABWASSER-TECHNIK),**  
For primary bibliographic entry see Field 5A.  
W75-10185

**NEW FLOWMETER PASSES TESTS,**  
General Signal Corp., West Warwick, R.I.  
For primary bibliographic entry see Field 5D.  
W75-10190

**WATER POLLUTION MONITORING SYSTEM, (IN JAPANESE),**  
For primary bibliographic entry see Field 5A.  
W75-10196

**ROUTINE SURVEILLANCE ALTERNATIVES FOR WATER QUALITY MANAGEMENT,**  
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 5A.  
W75-10250

**TV SYSTEM GIVES AUTOMATIC ALARM AS WESS AS VISUAL MONITORING OF AIR AND WATER POLLUTION.**  
For primary bibliographic entry see Field 5A.  
W75-10263

**WATER MONITORING IS BIG BUSINESS.**  
For primary bibliographic entry see Field 5A.  
W75-10269

**CHARACTERISTICS OF GAS-LIQUID CONTACT APPARATUS IN OZONE TREATMENT FOR DRINKING WATER, (IN JAPANESE),**  
For primary bibliographic entry see Field 5F.  
W75-10281

### 7C. Evaluation, Processing and Publication

**FINITE ELEMENT MODELING OF FLOW THROUGH POROUS MEDIA,**  
State Univ., of New York, Buffalo. Faculty of Engineering and Applied Sciences.  
For primary bibliographic entry see Field 5B.  
W75-09900

**RAIN STIMULATION EXPERIMENTS: DESIGN AND EVALUATION,**  
California Univ., Berkeley. Statistical Lab.  
J. Neyman, and E. L. Scott.

In: Proceedings of the World Meteorological Organization/International Association of Meteorology and Atmospheric Physics Scientific Conference on Weather Modification, October 1-7, 1973, Tashkent (USSR) WMO No 399, Geneva (Switzerland), p 449-457, 1974. 5 fig, 2 tab, 13 ref. ONR Contract N00014-69-A-0200-1060.

Descriptors: \*Weather modification, \*Evaluation, Effects, \*Cloud seeding, \*Design, Statistics, Cloud physics, Climatology, Meteorology, Model studies, \*Artificial precipitation, Rainfall.  
Identifiers: Extra-area effects, Downwind effects.

Because of the inordinate variability of natural rainfall from one unit of observation to the next and because of the changes in rainfall regimes each lasting several years, the only method now known of gaining reliable information on possible effects of cloud seeding is through properly designed randomized experiments. The establishment of rain stimulation technology requires a theory of the atmospheric phenomena resulting from cloud seeding, a theory that is empirically verifiable. This verification can be accomplished only through randomized experiments. The effects of cloud seeding observed empirically in randomized experiments are occasionally positive, occasionally negative, and occasionally no change, and are extensive in both time and place. With reference to summer convective clouds, several interrelated but independently conceived mechanisms of post cloud-seeding phenomena have been suggested. Contrary to experimental situations in many other domains, experiments with rain stimulation are 'multidimensional,' involving such questions as (1) How far does the effect of cloud seeding extend, and (2) When does the effect of cloud seeding begin and when does it end. No statistical theory applicable to such questions exists. Its development requires the cooperation of active mathematical statisticians. (See also W75-09944) (Sims-ISWS)  
W75-09994

**QUANTITATIVE ERROR ANALYSIS OF NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS,**  
Rutgers - the State Univ., New Brunswick, N.J. Dept. of Computer Science.  
For primary bibliographic entry see Field 6G.  
W75-10003

**CLIMATE OF MINNESOTA - PART VII - AREAL DISTRIBUTION AND PROBABILITIES OF PRECIPITATION IN THE MINNEAPOLIS-ST. PAUL METROPOLITAN AREA,**  
Minnesota Agricultural Experiment Station, St. Paul.  
For primary bibliographic entry see Field 2B.  
W75-10009

**SURFACE WATER DATA, REFERENCE INDEX, CANADA 1974.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1974. 265 p.

Descriptors: \*Canada, \*Surface waters, \*Data collections, \*Hydrometry, Gaging, Gaging stations, Measurement, On-site data collections, Drainage area, Discharge measurement, Indexing, Gages, Rivers, Lakes, Streams, Tributaries, Stage-discharge relations, Water levels.

Hydrometric surveys are conducted by the Water Survey of Canada under various agreements with the provinces and territories who contributed to the cost of the basic field investigations which were carried out in accordance with mutually agreed-upon plans. The first edition of a Surface Water Data Reference Index for each province or region was published for 1966. Subsequent editions are published annually. The gaging stations are listed by province or territory, in an upstream to downstream order. The main body of this Index is a tabulation of stations showing station number and name, drainage area, gage location, discharge records, type of gage, operation schedule, and remarks. The names of rivers and lakes for which data are available are given in a station number index and an alphabetical index. The overall accuracy of hydrometric data referred to depends on (1) the stability of the stage-discharge relationship; or if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of observations of stage, measurements of discharge, and interpretation of records. In general, data collected during open-water periods are more reliable than those collected during periods of ice conditions or those obtained by estimation. Further, water level data collected utilizing a water-stage recorder are more reliable and accurate than those using a manual gage only, especially for small or flashy streams. (Scott-ISWS)  
W75-10064

**HISTORICAL STREAMFLOW SUMMARY, BRITISH COLUMBIA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1975. 694 p.

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Streamflow, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average, Annual.  
Identifiers: \*British Columbia, Daily.

Hydrometric surveys in British Columbia are conducted by the Water Survey of Canada under agreement with the Province of British Columbia. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area, and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain data for all streamflow stations for the entire period of record not just the data for the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)  
W75-10065

**HISTORICAL STREAMFLOW SUMMARY, ONTARIO, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1975. 349 p.

## RESOURCES DATA—Field 7

### Evaluation, Processing and Publication—Group 7C

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Streamflow, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average, Annual. Identifiers: \*Ontario, \*Quebec, Daily.

Hydrometric surveys at stations in Ontario, including those stations operated in Quebec, are conducted by the Water Survey of Canada. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area, and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain data for all streamflow stations for the entire period of record not just the data for the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)

W75-10066

**HISTORICAL STREAMFLOW SUMMARY, ALBERTA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1974. 327 p.

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Streamflow, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average, Annual. Identifiers: \*Alberta, Daily.

Hydrometric surveys in Alberta are conducted by the Water Survey of Canada under agreement with the Province of Alberta. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area, and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain data for all streamflow stations for the entire period of record not just the data for the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)

W75-10067

**HISTORICAL STREAMFLOW SUMMARY, YUKON AND NORTHWEST TERRITORIES, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).

Information Canada, Ottawa, 1974. 50 p.

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average, Annual. Identifiers: \*Northwest Territories, \*Yukon Territory, Daily.

Hydrometric surveys in the Yukon and Northwest Territories are conducted by the Water Survey of Canada under agreement with the Territories. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain data for all streamflow stations for the entire period of record not just the data for the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)

W75-10068

**HISTORICAL STREAMFLOW SUMMARY, MANITOBA, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1974. 161 p.

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average. Identifiers: \*Manitoba, Daily.

Hydrometric surveys in Manitoba are conducted by the Water Survey of Canada under agreement with the Province of Manitoba. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area, and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain data for all streamflow stations for the entire period of record not just the data for the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)

W75-10069

**HISTORICAL STREAMFLOW SUMMARY, SASKATCHEWAN, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1975. 250 p.

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average, Annual. Identifiers: \*Saskatchewan, Daily.

Hydrometric surveys in Saskatchewan are conducted by the Water Survey of Canada under agreement with the Province of Saskatchewan. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area, and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)

W75-10070

**HISTORICAL STREAMFLOW SUMMARY, ATLANTIC PROVINCES, TO 1973.**  
Water Survey of Canada, Ottawa (Ontario).  
Information Canada, Ottawa, 1974. 135 p.

Descriptors: \*Canada, \*Hydrometry, \*Basic data collections, \*Gaging stations, Discharge(Water), Flow, Drainage area, Measurement, Surface waters, On-site data collections, Discharge measurement, Flow rates, Annual mean discharge, Monthly, Average, Annual. Identifiers: \*Newfoundland and Labrador, \*New Brunswick, \*Nova Scotia, \*Prince Edward Island, Daily.

Hydrometric surveys in Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island are conducted by the Water Survey of Canada under individual cooperative arrangements with each provincial government or its agency. Descriptive information about gaging stations was given in tables of monthly and annual mean discharges. This included such items as latitude and longitude, drainage area, and whether the flow is natural or regulated (the year that regulation began was given, if known). International Gauging Stations were identified and the names of cooperating agencies who supply data were given. Unusual conditions were explained. The Historical Streamflow Summary publications contain data for both active and discontinued streamflow stations and do not contain any water level data. These publications are published every three years and contain data for all streamflow stations for the entire period of record not just the data for the intervening three years. For gaging stations where systematic streamflow data were obtained, the following were tabulated for the period of record to 1973 inclusive: (1) summary of monthly and annual mean discharges, (2) annual maximum instantaneous discharges, (3) annual maximum and minimum daily discharges, (4) identification of the extreme recorded for the period of record, (5) annual total discharge in acre-feet. A number of corrections or revisions were made to previously published data. (Scott-ISWS)

## Field 7—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

W75-10071

**A COMPUTER SIMULATION ANALYSIS OF SURFACE WATER QUALITY MANAGEMENT POLICIES UNDER DYNAMIC ECONOMIC AND HYDROLOGIC CONDITIONS,**  
Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.  
For primary bibliographic entry see Field 5D.  
W75-10124

**A MATHEMATICAL PROGRAMMING APPROACH TO PUBLIC WATER PROJECT PORTFOLIO SELECTION,**  
Georgia Univ., Athens.  
For primary bibliographic entry see Field 6B.  
W75-10131

**A MODEL OF ONE-DIMENSIONAL PERCOLATION TO A WATER TABLE USING A COMPUTER SIMULATION LANGUAGE,**  
Clemson Univ., S.C. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 2G.  
W75-10138

**DISCHARGE MEASUREMENTS AT LOW-FLOW PARTIAL-RECORD STATIONS IN IOWA.**  
Geological Survey, Iowa City, Iowa.  
Open-file report, May 1975. 157 p.

Descriptors: \*Streamflow, \*Low flow, \*Iowa, Data collections, Discharge measurement, Basic data collections, Base flow, Gaging stations, Flow characteristics, Hydrologic data.  
Identifiers: Partial-record stations(Iowa).

This report compiles discharge measurements made at 433 low-flow partial-record stations in Iowa during the period 1957-74. A low-flow partial-record station is a site at which low-flow discharge measurements are made systematically over a period of years. Most of these measurements were made during periods of base flow when streamflow is primarily from groundwater sources. For estimating characteristics of low flows at a partial record site, the baseflow measurements are correlated with concurrent flows at nearby gaging stations where continuous records are available. By using these relations the flow characteristics at the gaging station are transferred to the partial-record site. The listing starts with streams in the Mississippi River basin (Part 5) and is followed by streams in the Missouri River basin (Part 6). After the station number and name are descriptive paragraphs containing information on the location and the drainage area. These are followed by tabulation of the discharge measurements in chronological order. (Woodard-USGS)  
W75-10144

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1973,**  
Geological Survey, Austin, Tex.  
B. B. Hampton.  
Open-file report, June 1975. 146 p, 4 fig, 3 tab, 7 ref.

Descriptors: \*Hydrologic data, \*Urban runoff, \*Watersheds(Basins), \*Urban hydrology, \*Texas, Rainfall, Storm runoff, Data collections, Runoff, Hydrographs, Mass curves, Water yield, Discharge(Water), Urbanization, Watershed management.  
Identifiers: \*Dallas(Tex).

This report presents the compilation and analysis of hydrologic data collected in urban or partly urban drainage basins in the Dallas, Texas, metropolitan area during the 1973 water year. The objectives of the Dallas area program are: To

determine, on the basis of historical data and hydrologic analyses, the magnitude, frequency and areal extent of flooding; to document and define floods of greater than ordinary magnitude; and to determine the effect of urban development on flood peaks and volume. During the 1973 water year, storms producing the highest peak discharges occurred on March 9-10; April 23-24; May 11-12; June 3-4, 19-21; July 7-8; and Sept. 26-27, 1973. These storms produced a variety of rainfall amounts, intensities, durations, and distribution in the drainage basins. Weighted rainfall, for these storm periods upstream from continuous-record gaging stations and selected crest-stage partial-record stations, are given. The storm analyses, hydrographs, and mass curves also are included. (Woodard-USGS)  
W75-10148

**HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS, 1973,**  
Geological Survey, Austin, Tex.  
R. M. Slade, Jr.  
Open-file report, May 1975. 44 p, 2 fig, 3 tab.

Descriptors: \*Flood control, \*Check structures, \*Retaining walls, \*Hydrologic data, \*Texas, Runoff, \*Watershed management, Basic data collections, Watershed protect, \*Flood Prev. Act, Water resources development.  
Identifiers: Tarrant County(Tex), Trinity River Basin(Tex).

During the period 1951-62, the U.S. Geological Survey began hydrologic investigations in 12 small watersheds in cooperation with the Texas Water Development Board, the Soil Conservation Service, the San Antonio River Authority, the city of Dallas, and the Tarrant County Water Control and Improvement District No. 1. The 12 study areas were chosen to sample watersheds having different rainfall, topography, geology, and soils. In five of the study areas (North, Little Elm, Muke-water, Little Pond-North Elm, and Pin Oak Creeks), streamflow and rainfall records were collected prior to construction of the floodwater-retarding structures, thus affording the opportunity for analyses of the conditions 'before and after' development. A summary of the development of the floodwater-retarding structures in summary of the development of the floodwater-retarding structures in each study area as of Sept. 30, 1973, is tabulated. This watershed-development program will have varying but important effects on surface- and ground-water resources of river basins, especially where a large number of the floodwater-retarding structures are built. (Woodard-USGS)  
W75-10149

**HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1973,**  
Geological Survey, Austin, Tex.  
H. D. Buckner.  
Open-file report, May 1975. 13 p, 1 fig.

Descriptors: \*Hydrologic data, \*Watersheds(Basins), \*Texas, Streamflow, Discharge(Water), Gaging stations, Rainfall, Water yield, Reservoirs, \*Watershed management, Flood control, Retaining walls, Reservoir yield, Water levels.  
Identifiers: \*Mountain Creek(Tex), \*Trinity River basin(Tex).

The stream-gaging stations on Mountain Creek near Cedar Hill and Walnut Creek near Mansfield, Texas provide hydrologic data to define runoff characteristics from small drainage basins. They also serve as index stations for inflow into the reservoir and provide operational data for the reservoir. In addition, the station Walnut Creek near Mansfield is equipped with a recording rain gage. The stage station near Duncanville provides data pertinent to operation of the gates in the Mountain Creek Lake Dam. The reservoir-content station at the dam provides records of reservoir

stage and contents. The stream-gaging station Mountain Creek at Grand Prairie provides records of outflow from Mountain Creek Lake and the basin. Basin outflow for the 1973 water year was 161,400 acre-feet which is 89,020 acre-feet above the 13-year average (1960-73) of 72,380 acre-feet. Storage in Mountain Creek Lake showed a net gain of 6,350 acre-feet during the water year. Rainfall for the 1973 water year was about 46 inches, which is about 12 inches above the long-term mean (1960-73). (Woodard-USGS)  
W75-10150

**HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1973,**  
Geological Survey, Austin, Tex.  
R. N. Mitchell.

Open-file report May 1975. 61 p, 3 fig, 1 tab.

Descriptors: \*Hydrologic data, \*Urban runoff, \*Watersheds(Basin), \*Urban hydrology, \*Texas, Runoff, Rainfall, Storm runoff, Data collections, Hydrographs, Mass curves, \*Watershed management, Water yield, Urbanization.  
Identifiers: \*Austin(Tex).

Rainfall and runoff data are tabulated for Waller and Wilbarger Creeks in the Austin, Tex. metropolitan area for the 1973 water year (October 1, 1972 to September 30, 1973). The weighted-mean rainfall in the Waller Creek study area upstream from 38th Street was 40.10 inches, or 23% above the mean annual rainfall for Austin of 32.49 inches. Mean daily discharge was 1.75 cfs; annual runoff was 10.27 inches, or 26% of rainfall. The weighted-mean rainfall upstream from 23d Street was 40.13 inches, or 24% above the mean annual rainfall for Austin. Mean daily discharge was 3.77 cfs; annual runoff was 12.38 inches, or 31% of rainfall. Weighted-mean rainfall in the Wilbarger Creek study area was 36.32 inches, or 12% above the mean annual rainfall for Austin of 32.49 inches. Mean daily discharge was 2.19 cfs; annual runoff was 6.44 inches, or 18% of rainfall. Rainfall-runoff data for 5 storms are summarized. Computations with hydrograph and mass curves are included for each storm. (Woodard-USGS)  
W75-10151

**CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1970-SEPTEMBER 1971,**  
Geological Survey, Austin, Tex.  
D. C. Hahl, and K. W. Ratzlaff.

Texas Water Development Board, Austin, Report 191, May 1975. 153 p, 13 fig, 8 tab, 11 ref.

Descriptors: \*Estuaries, \*Water quality, \*Texas, \*Gulf of Mexico, Mixing, Bays, Currents(Water), Physical properties, Sampling, Methodology, Chemical analysis, Estuarine environment, Inflow, Encroachment, Tidal effects, Hydrologic data, Data collections, Nutrients, Inorganic compounds, Organic compounds.

In September 1967, the U.S. Geological Survey and the Texas Water Development Board began a cooperative water-resources investigation of the principal estuaries along the Texas coast except Galveston Bay and the Rio Grande. The objectives of the investigation are to define: (1) The occurrence, source, and distribution of nutrients; (2) the physical, organic, and inorganic water-quality constituents and their areal distribution and time variations; (3) the chemical and physical characteristics of Gulf water that enters the estuaries; (4) the occurrence, quality, quantity, and dispersion of drainage entering the estuarine systems; and (5) the current patterns, directions, and rates of water movement. This report is the fourth in an annual series of basic-data reports and includes more than 100 pages of tabulated data collected during the 1971 water year. (Woodard-USGS)  
W75-10153

## ENGINEERING WORKS—Field 8

### Structures—Group 8A

**EVAPORATION DATA IN TEXAS—COMPILED REPORT, JANUARY 1907-DECEMBER 1970.**  
Texas Water Development Board, Austin.  
J. P. Dougherty.  
Report 192, June 1975. 237 p, 6 fig.

Descriptors: \*Evaporation, \*Basic data collections, \*Texas, Surface waters, Evaporation pans, Atmometers, Methodology, Hydrologic data.

A compilation of all available historical pan-evaporation data which have been obtained in Texas, spanning a 64-year period from January 1907 through December 1970 is tabulated. This compilation of evaporation data was gathered from 114 stations which have been in operation in Texas during some part of the period 1907-70. Locations of these stations are shown. The bulk of evaporation measurements were made from three types of evaporation pans. They are the Bureau of Plant Industry pan (BPI), National Weather Service pan (WS), and the Young screen pan (Y). Several other pan types and the evaporometer have been utilized in Texas, but the volume of record obtained with these is small compared to that from the three main types of evaporation pans. (Woodard-USGS)  
W75-10154

**DIGITAL PROGRAM FOR WATER NETWORK ANALYSIS,**  
Water Research Association, Marlow(England).  
Economics Group.  
R. P. Donachie.  
Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY3, Paper No 10424, p 393-403, March 1974. 4 fig, 2 tab, 15 equ, 4 ref.

Descriptors: \*Water distribution(Applied), \*Computer programs, \*Systems analysis, \*Hydraulics, \*Networks, Digital computers, Pressure, Pipes, Valves, Pumps, Engineering, Equations, Low flow, Mathematical models.  
Identifiers: \*Newton-Raphson method, Matrices(Mathematics).

Described is a digital computer program for the rapid and efficient analysis of water distribution networks. Pressures and flows are solved by a modified Newton-Raphson method. This method removes the problems of pressure initialization and greatly increases convergence, particularly in systems containing pumps or pressure-reducing valves, or both. The program incorporates an automatic balancing routine which greatly reduces the effort in the initial balancing of the model against the real system. This same routine can also be used for the sizing of reinforcement mains to enable the system to meet future demands; work is now being extended to incorporate full recognition of cost factors. The program will automatically amend pipe resistances so that calculated pressures agree with measured pressures. Both the system equations and those for the automatic balancing routine are derived. The program uses either Imperial or SI units, the choice being specified by the user. Examples are shown of the improved rate of convergence and the automatic balancing. Modifications to the normal Newton-Raphson technique are described which lead to improved computing efficiency and to improved stability of the program under low flow conditions. (Bell-Cornell)  
W75-10220

**COMPUTER CONTROL OF SEWAGE WORKS, PROGRESS AT NORWICH,**  
For primary bibliographic entry see Field 5D.  
W75-10246

**COMPUTERIZED SEWER DESIGN: NEW TOOL FOR AN OLD PROBLEM,**  
Boyle Engineering, Santa Ana, Calif.  
For primary bibliographic entry see Field 5D.  
W75-10253

**A DIMENSIONLESS DESIGN EQUATION FOR SEWAGE LAGOONS,**  
New Mexico Univ., Albuquerque.  
For primary bibliographic entry see Field 5D.  
W75-10261

**CALIFORNIA PLANT GETS STRAIGHT 'A'S IN COMPUTER CONTROL,**  
San Jose-Santa Clara Water Pollution Control Plant, San Jose, Calif.  
For primary bibliographic entry see Field 5D.  
W75-10264

**A COMPUTER COMES TO MISSOURI,**  
Springfield Water Dept., Mo.  
For primary bibliographic entry see Field 5D.  
W75-10265

## 8. ENGINEERING WORKS

### 8A. Structures

#### ARTIFICIAL REEF,

E. R. Boots.  
US Patent No 3,888,209, 6 p, 6 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 935, No 2, p 547, June 10, 1975.

Descriptors: \*Patents, \*Beach erosion, Shore protection, Coastal structures, Reefs, Deposition(Sediments).  
Identifiers: Artificial reefs, Marine organisms.

The object of the invention is to provide a practical method and apparatus for offshore reef construction which serves to correct an imbalance in the natural accretion-degradation cycle so as to prevent substantial erosion of a beach area by the net movement of beach materials away from the shore. An offshore submerged reef structure is in a form which may be transported to and placed in the desired offshore location and built up to a desired height. The base reef element is preferably secured to the ocean floor by pile members or stakes which are passed through the base element and driven into the ocean floor. The base reef element is preferably of inverted U-shaped cross section having openings to permit sand and other particulate matter normally held in suspension in the sea water to deposit and settle within the reef structure to afford it greater anchorage and stability. The base reef element may serve as the habitat for an implanted marine organism, such as a scleractinian organism, which over the years will continue to grow and build up the size and height of the reef. Composite artificial reefs are arranged end-to-end and relative to the shoreline so as to interfere with the destructive shoreline currents by deflecting the incoming waves. (Sinha-OEIS)  
W75-09879

**DESIGN IMPLICATIONS OF HYDRAULIC JUMPS AT SUDDEN ENLARGEMENTS,**  
Mozambique Univ., Lourenco Marques. Dept. of Civil Engineering.

For primary bibliographic entry see Field 8B.  
W75-10061

#### ARTIFICIAL REEFS FOR TEXAS.

Texas A and M Univ., College Station. Industrial Economics Research Div.  
For primary bibliographic entry see Field 3E.  
W75-10119

**DESIGN OF SURFACE WATER OUTFALLS TO RIVERS,**

Lothians River Purification Board (Scotland).  
For primary bibliographic entry see Field 5D.  
W75-10183

**RECOMMENDATIONS FOR ENVIRONMENTAL ENGINEERING EDUCATION,**  
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 9A.  
W75-10218

**SAFETY OF DAMS—BUREAU OF RECLAMATION,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
D. A. Gray.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY2, Paper No 10354, p 267-277, February 1974. 1 fig, 1 tab, 2 ref.

Descriptors: \*Dams, \*Safety, \*Hydraulics, \*Governments, \*Reclamation, \*Water resources, \*Spillways, \*Reservoirs, Design, Earthquakes, Floods, Hydrology, Legislation, Landslides, Water supply, Water works, Concrete dams, Earth dams, Maintenance.  
Identifiers: Systems engineering.

The program of the Bureau of Reclamation for monitoring the safety of its existing dams includes periodic examinations, dam behavior measurements, spillway capacity reevaluations, seismic and other structural reevaluations, operating instruction documentation and updating, and landslide and upstream dam surveillance. The Bureau has responsibility for the safety of dams for 240 reservoirs with capacities ranging from 1,000 acre-ft. to 29,755,000 acre-ft., all located in 17 western states. Its reservoirs of 5,000 acre-ft. or more in capacity total approximately one-tenth of those in the United States. Recent studies have revealed that a substantial number of Bureau dams constructed before 1950 require spillway capacity determinations using present day hydrologic techniques and data. The adequacy of spillway capacity at older dams of significant size in the United States should be reviewed. (Bell-Cornell)  
W75-10221

**COMPUTERIZED SEWER DESIGN: NEW TOOL FOR AN OLD PROBLEM,**  
Boyle Engineering, Santa Ana, Calif.  
For primary bibliographic entry see Field 5D.  
W75-10253

**THE DEVELOPMENT OF A SCHEME TO CONSTRUCT LARGE DIAMETER SEWAGE PUMPING MAINS ACROSS THE RIVER TEES AND THE TEE'S RAILWAY MARSHALLING YARD,**  
For primary bibliographic entry see Field 5D.  
W75-10275

#### AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Washington, D.C.  
Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-UT-73-1289-F-1, \$21.25 in paper copy, \$2.25 in microfiche. August 2, 1973. 941 p, 56 map, 32 tab, 24 fig, 6 graph, 13 photo.

Descriptors: \*Utah, \*Diversion structures, \*Irrigation systems, \*Water supply development, Reservoirs, Pumping plants, Aqueducts, Tunnels, Canals, Drains, Dikes, Industrial water, Wildlife habitats, Fishing, Recreation, Salinity, Colorado River, Aesthetics, Community development.  
Identifiers: \*Environmental impact statements, \*Uinta Basin(Utah), \*Bonneville Basin(Utah).

The project will divert water from the Uinta Basin in the Bonneville Basin in Utah. This will be accomplished by construction of new reservoirs and enlargement of existing reservoirs; construction of 140 miles of aqueducts, tunnels and canals; three power plants; nine pumping plants; 13 miles of dikes and 200 miles of pipe drains. The project will

## Field 8—ENGINEERING WORKS

### Group 8A—Structures

supply immediate and projected water needs for irrigation, municipal and industrial needs and power production. In some areas, the project will have a significant adverse effect on fish and wildlife habitats as well as loss of quality fishing and stream recreation. In the areas of the reservoirs, however, fishing and water related sports will be substantially increased. Two other effects will be increased salinity of the Colorado River and permanent aesthetic land changes. Alternatives considered were alternate sources of water, various scales of partial construction or non-construction of authorized unit and alternative location. (Altuve-Florida)  
W75-10292

#### INITIAL STAGE, GARRISON DIVERSION UNIT, PICK-SLOAN MISSOURI BASIN PROGRAM, NORTH DAKOTA (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Billings, Mont. Upper Missouri Region.

Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-ND-74-0058-F, \$17.25 in paper copy, \$2.25 in microfiche. January 10, 1974. 740 p, 61 fig, 22 dwg, 12 tab, 2 append.

Descriptors: \*Environmental effects, \*Missouri River, \*North Dakota, \*River basin development, \*Water supply development, Central U.S., Reservoirs, Irrigation water, Reservoir construction, Water yield improvement, Recreation, Water management(Applied), Water distribution(Applied), Irrigation systems, Diversion, Alteration of flow, Canals, Irrigation canals, Lateral conveyance structures, Agriculture, Wildlife habitats, Lakes, Streamflow, Federal government, Water resources development.

Identifiers: \*Environmental impact statements, Missouri River(ND), Lake Lakakamea(ND).

The project entails construction of a system of reservoirs, canals, and laterals to divert water from the Missouri River and Lake Lakakamea in the Missouri Basin of North Dakota. About 30% of the population of North Dakota resides in the project area, which is predominantly rural and agricultural. As a result of the project, substantial water supplies will be provided for irrigation, municipal and industrial use, fish and wildlife developments, outdoor recreation, and improvement of base flows of local streams. Adverse environmental effects include a 5% flow depletion in the Missouri River, increased stream salinity, stabilized flow of intermittent streams, intrusion of rough fish, and inundation of some archaeological sites. Alternatives considered were: no development, precipitation management, use of ground water, alternate locations, and modification of planned distribution systems. Although the short-term uses of the area will be hampered by construction activity and temporary disruption of wildlife habitats, long-term benefits will be gained in agriculture, water resources and quality, recreation, and the economy. In addition to commitments of water and land resources, electric power, construction materials, and public and private funds, there will be irreversible losses of vegetation, wildlife, archaeological, and mineral resources. Comments indicated overwhelming support of the project. (Fernandez-Florida)  
W75-10296

#### CLAYTON LAKE, JACK FORK CREEK, OKLAHOMA (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Tulsa, Okla.

Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-OK-74-0199-F.

Descriptors: \*Environmental effects, \*Oklahoma, \*Dam construction, \*Flood routing, \*Water supply, Dams, Check structures, Damsites, Water control, Water storage, Water manage-

ment(Applied), Flood control, Water supply development, Federal government, Flood protection, Streams, Artificial lakes, Archaeology, Recreation, Agriculture, Lumber, Wildlife, Waterfowl, Vegetation effects.

Identifiers: \*Environmental impact statements, \*Clayton(Okla), Dam effects, Jackfork Creek(Okla).

The project involves the construction of a dam and lake on Jackfork Creek, north of Clayton, Oklahoma. The mountainous terrain is covered with timber of commercial value, and small areas are used for pasture and cultivation. Significant reduction of annual flood damage and production of a dependable water supply are expected to be the main impacts of the project together with enhanced recreational resources. Adverse effects will be suffered by animal and plant life, stream-oriented recreation, archaeological sites, and numerous families, roads, and utility lines which must be relocated. Alternatives considered were: (1) no action, (2) defer water management to other government agencies, (3) construct a dry lake, (4) utilize upstream multipurpose projects, (5) use levees, and (6) acquire flood plain rights. The benefits of the lake to the area outweigh maintaining the status quo because the project will enhance the environment for a larger number of people than is possible under the present use. Resources committed to developing lands for the present agricultural use and costs of dam construction and road relocation cannot be regained. Generally, comments indicated concern over destruction of the present environment. (Fernandez-Florida)  
W75-10297

#### WARM SPRINGS DAM AND LAKE SONOMA PROJECT, RUSSIAN RIVER BASIN, SONOMA COUNTY, CALIFORNIA, PART I (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, San Francisco, Calif.

Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-CA-73-1910-F-1, \$10.50 in paper copy, \$2.25 in microfiche. December 10, 1973. 415 p, 4 fig, 15 plate, 16 photo, 5 append.

Descriptors: \*Dams, \*Reservoirs, \*Channel improvement, \*Water supply, \*Flood protection, \*Channel improvement, \*Water supply, \*Flood protection, Levees, Earth dams, \*California, Recreation, Fish hatcheries, Environmental effects, Erosion, Dusts, Turbidity, Air environment, Wildlife, Mosquitoes, Litter, Water supply development, Anadromous fish, Flood plains. Identifiers: \*Environmental impact statements, \*Dry Creek(Calif).

The project entails the construction of an earthfill dam 319 feet high on Dry Creek, California, which will impound a reservoir having a capacity of 381,000 acre-feet. The project includes recreation facilities, a fish hatchery, and channel improvements. A total of 17,650 acres of land will be acquired. Short-term environmental effects of the project include increased erosion, dust and stream turbidity, changed air quality, increased noise, loss of wildlife habitat, unsightly spoil disposal, clearing operations, cut slopes, increased litter, mosquitoes, and rattlesnake exposure. The long-term environmental effects include increased water supply, decreased flooding of downstream areas, changed stream flow regime, reduced downstream sediment transport, changed channel conditions, gravel operations and closure pattern, improved anadromous fishery, increased recreational opportunities and traffic, and the possibility of reduced seismic activity. The following alternatives were considered: other scales of development at the same site; selection of another nearby site for the dam; construction of one or more other dams; combination of non-reservoir alternatives, such as levees, wastewater reclamation, better utilization of existing water supplies, control of flood plain land uses, and no action. (See also W75-10299) (Gagliardi-Florida)  
W75-10298

#### WARM SPRINGS DAM AND LAKE SONOMA PROJECT, RUSSIAN RIVER BASIN, SONOMA COUNTY, CALIFORNIA, PART II (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, San Francisco, Calif.

Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-CA-73-1910-F-2, \$12.25 in paper copy, \$2.25 in microfiche. December 10, 1973. 506 p, 3 fig.

Descriptors: \*Dams, \*California, Environmental control, Environment, Springs, Lakes, Rivers, Environmental effects.

Identifiers: \*Environmental impact statements, \*Sonoma County(Calif), Russian River basin(Calif).

Part II of the Warm Springs Dam and Lake Sonoma Project, Russian River Basin, Sonoma County, California, environmental impact statement consists of thirty-three comments from various agencies, groups and individuals. Comments were received from the United States Departments of Agriculture, Commerce, Interior, and Transportation, and the Environmental Protection Agency and Federal Power Commission, and the Friends of the Earth and Sierra Club. (See also W75-10298) (Gagliardi-Florida)  
W75-10299

#### MOUNTAIN PARK RECLAMATION PROJECT, OKLAHOMA—NUCES RIVER PROJECT, TEXAS.

For primary bibliographic entry see Field 4A.  
W75-10319

#### AUTHORIZED BONNEVILLE UNIT, CENTRAL UTAH PROJECT, UTAH APPENDIX A (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Bureau of Reclamation, Washington, D.C.

Available from National Technical Information Service, Springfield, Va 22161, USDC, as EIS-UT-73-1289-F-2, \$13.25 in paper copy, \$2.25 in microfiche. August 2, 1973. 592 p.

Descriptors: \*Utah, \*River basin development, \*Environmental effects, \*Water supply development, Water resources development, Federal government, Effects, Environment, Ecology, Habitats, Irrigation effects, Population, Water conservation, Water conveyance, Water distribution(Applied), Resources, Resources development, Potential water supply, Water supply, Dams, Reservoirs. Identifiers: \*Environmental Impact Statements, \*Orem(Utah), Dam effects, Environmental policy.

These materials comprise Appendix A of the Final Environmental Statement for the Bonneville Unit, Central Utah Project, Utah. Contents consist of written comments which were received in review of the August 14, 1972, draft environmental statement and in connection with the September 22 and 23, 1972, public hearing at Orem, Utah. The main objective of the project is to provide 313,000 acre feet of additional water to the Great Basin of Utah for continued municipal and industrial expansion. In accomplishing this objective, construction of dams, reservoirs, aqueducts, tunnels, canals, and pumping plants will be necessary. A number of commentators found the project to be a welcome answer to the area's water needs. (Fernandez-Florida)  
W75-10331

## 8B. Hydraulics

#### SUDDEN RELEASE OF WATER FROM A LONG PRISMATIC FLUME, Mississippi State Univ., Mississippi State. Dept. of Agricultural and Biological Engineering. J. C. McWhorter, and J. B. Allen.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243

## ENGINEERING WORKS—Field 8

### Hydraulics—Group 8B

780, \$3.75 in paper copy, \$2.25 in microfiche. Mississippi Water Resources Research Institute, Mississippi State, Completion Report, July 1975. 24 p., 15 fig., 4 tab., 5 ref. OWRT A-086-MISS(1).

Descriptors: \*Hydraulics, Unsteady flow, \*Velocity, \*Flumes, \*Open channel flow, \*Flow characteristics, Dye releases, \*Dye dispersion, Distribution.

Identifiers: Velocity distribution curves.

The purpose was to acquire both qualitative and quantitative knowledge of flow characteristics resulting from the sudden release of water from one end of a long, straight flume of rectangular cross section. The flume bottom was adjusted to a horizontal plane, filled to the desired still water depth, and the quick-opening gate was released. Movie cameras were located on a line parallel to the long axis of the flume in order to photograph the water movements at 5 predetermined stations. Synchronized clocks were located along the flume wall at each station and indicated the time after the release of the gate. Dye was injected into the water from vertically spaced openings at each station at various time intervals. The glass wall of the flume was marked with a grid system at each station so that photographs showed the position of the dye, the water depth, and the time. This procedure permitted the determination of the velocity at any time, depth, and station. Volume changes from the profile enabled the calculation of average velocities. Tests were conducted with the flume horizontal and filled to 4 different initial depths. The movement of the dye at each station immediately after the sudden release of the gate was studied. The advancing dye front presented a velocity distribution curve.

W75-10017

**HYDRAULIC MODEL STUDY OF A LARGE-CAPACITY SETTLER IN A WATER CAPTURE SYSTEM (BANADIA HYDRAULICZNE MODELU DUZEGO OSADNIKA NA UJECIU WODOCIAGOWYM),** For primary bibliographic entry see Field 5D. W75-10043

**MEASUREMENT OF SMALL DISCHARGES THROUGH V-NOTCH WEIRS,** Leupold and Stevens, Inc., Beaverton, Oreg. N. Leupold, Jr., and R. S. Blois. Water and Sewage Works, Reference Number 1975, p R148-R150, April 30, 1975. 1 fig., 4 tab.

Descriptors: \*Weirs, \*Discharge(Water), \*Flow measurement, Streamflow, Flowmeters, Flow rates, Water measurement, Sewers, Open channels, Irrigation canals.

Identifiers: V-notch weirs.

Discharge measurement of small streams, irrigation canals, sewers, and other open channels can be satisfactorily achieved with the use of V-notch weirs. The four sizes of V-notches commonly used are 90, 60, 45, and 22.5 deg. The size selected will depend on the expected maximum flow and the allowable depth over the weir. Minimum recommended depths of flow over V-notch weirs were 0.2 ft for 90 deg, and 0.1 ft for 45 and 22.5 deg. If a float-operator instrument is used to continuously record the water level, it is important to select a weir size that will give at least 0.3 ft of head for the average low-flow condition. Construction suggestions were discussed for installation of temporary and permanent weirs. Discharges in cubic feet per second and million gallons per day were tabulated for each weir size for heads ranging from 0.1 to 2.09 ft. (Humphreys-ISWS)

W75-10059

**HYDRODYNAMIC LEVELLING OF AN OFF-SHORE TIDE GAUGE,** Institute of Oceanographic Sciences, Taunton (England).

G. A. Alcock, and D. T. Pugh.

In: The Institution of Civil Engineers Proceedings, Part 2, Research and Theory, Vol 59, p 123-137, March 1975. 6 fig., 3 tab., 7 ref.

Descriptors: \*Tides, \*Hydrodynamics, \*Waves(Water), Mathematical models, Hydraulics, Water levels, Europe, Oceanography, Shallow water, Coasts, Gages, Currents(Water), On-site data collections, Model studies.

Identifiers: \*Offshore tides, \*Offshore water levels, Tidal cycle.

When designing structures which extend to a considerable distance offshore, it is desirable to have offshore measurements of water level which are referred to the same datum as simultaneous coastal measurements. By using the hydrodynamic equations and only limited current observations, a datum level was transferred to a gage 12.9-km offshore in the Wash on the east coast of England, across water of 7.5-m average depth, where the mean spring tidal range is 6.4 m. Mean values over a lunar tidal cycle were computed. By calculating the datum level on an hourly basis as well, the apparent datum variations were used to investigate the limitations of the simple model applied. Level transfer was estimated to be accurate to within 0.04 m; the maximum uncertainty arises in estimating the residual gradients due to advection and bottom friction terms. (Lee-ISWS)

W75-10060

**DESIGN IMPLICATIONS OF HYDRAULIC JUMPS AT SUDDEN ENLARGEMENTS,** Mozambique Univ., Lourenco Marques, Dept. of Civil Engineering.

L. E. de M. Magalhaes, and P. Minton.

In: The Institution of Civil Engineers Proceedings, Part 2, Research and Theory, Vol 59, p 169-174, March 1975. 5 fig., 1 tab., 7 ref.

Descriptors: \*Hydraulic jump, \*Hydraulic models, \*Hydraulic design, Open channel flow, Open channels, Hydraulics, Steady flow, Jets, Sluice gates, Channels, Gate control, Laboratory tests, Model studies, Cross-sections.

Identifiers: \*Sudden enlargement channels, Channel geometry.

A laboratory model study was described of the formation of hydraulic jumps at the junction between a narrow open channel with a fast flow and broad open channel with a slow flow (both flows in the same direction). The channels were rectangular in cross section with parallel side walls and a horizontal bed. The size of the model was large enough to suggest that the results should be applicable to full-scale river situations. The flow in the jet from the 0.2-m wide sluice gate in the narrow channel was measured by a calibrated orifice meter. The depth and Froude number of the jet were calculated from the depth upstream of the sluice by the energy equation. An independent water supply was provided for the 0.54-m wide broad channel to give a flow in the same direction as the flow in the narrow channel. The depth of water in the combined downstream channel, measured on the center line 2 m from the sluice, was controlled by the downstream weir. The results indicated that when a hydraulic jump occurs where it is not constrained to two dimensions, it will assume a form (oblique, normal, or submerged) appropriate to the conditions. The effects of many variables, such as the channel breadth ratio and the angle between the broad channel flow and the flow from the sluice, must be studied for a complete understanding of hydraulic jump formation. However, the information obtained confirms that hydraulic jumps at sudden enlargements form at a lower downstream depth than two-dimensional theory would indicate. Thus, a jump forming at an enlargement can submerge a sluice with a downstream depth less than that required to submerge the sluice in a two-dimensional flow. (Lee-ISWS)

W75-10061

**FRICITION COEFFICIENTS FOR LAMINAR SHEET FLOW OVER ROUGH SURFACES,** University of the West Indies, Kingston (Jamaica). H. O. Phelps.

In: The Institution of Civil Engineers Proceedings, Part 2, Research and Theory, Vol 59, p 21-41, March 1975. 16 fig., 5 tab., 17 ref.

Descriptors: \*Roughness(Hydraulic), \*Sheet flow, \*Overland flow, \*Laboratory tests, \*Flow resistance, Fluid mechanics, Reynolds number, Froude number, Hydraulics, Transition flow, Friction, Laminar flow, Dimensional analysis, Boundary layers.

Identifiers: Relative roughness.

Systematic tests of sheet flow in the laminar and transition regions were carried out on eight surfaces of varying degrees of roughness. The Darcy friction coefficient was the primary dependent variable. Analysis of the results showed that the product of the Darcy coefficient and the Reynolds number, a constant in steady laminar flow on a smooth surface, was a function of the relative roughness. It was also found that the critical value of the Reynolds number decreased as the relative roughness increased. Measurable effects, similar to those observed in turbulent flow over rough surfaces, were produced by changes in shape and concentration of roughness elements. The association of roll waves with the beginning of the transition region suggested that this form of instability contributed to the change of flow regime and lead to the conclusion that the Froude number was significant. The possibility of developing a roughness standard was explored. (Adams-ISWS)

W75-10062

**A MODEL FOR EARTHQUAKES NEAR PALISADES RESERVOIR, SOUTHEAST IDAHO,** Geological Survey, Denver, Colo. D. Schleicher.

Available from Sup Doc, GPO, Wash., D.C. 20402, \$3.15 single journal copy, \$18.90 yearly subscription rate. Journal of Research of the U.S. Geological Survey, Vol 3, No 4, p 393-400, July-August 1975. 7 fig., 21 ref.

Descriptors: \*Earthquakes, \*Reservoirs, \*Model studies, \*Idaho, \*Faults(Geologic), Water levels, Stress, Seasonal, Seismic properties.

Identifiers: \*Palisades Reservoir(Idaho), Epicenter.

The Palisades Reservoir, Idaho, seems to be triggering earthquakes: epicenters are concentrated near the reservoir, and quakes are concentrated in spring, when the reservoir level is highest or is rising most rapidly, and in fall, when the level is lowest. Both spring and fall quakes appear to be triggered by minor local stresses superposed on regional tectonic stresses; faulting is postulated to occur when the effective normal stress across a fault is decreased by a local increase in pore-fluid pressure. The spring quakes tend to occur when the reservoir level suddenly rises: increased pore pressure pushes apart the walls of the graben flooded by the reservoir, thus decreasing the effective normal stress across faults in the graben. The fall quakes tend to occur when the reservoir level is lowest: water that gradually infiltrated poorly permeable zones during high reservoir stands is then under anomalously high pressure, which decreases the effective normal stress across faults in the poorly permeable zones. (Woodard-USGS)

W75-10139

**INJECTION-PIPE SYSTEM FOR ARTIFICIAL RECHARGE,** Geological Survey, St. Paul, Minn. For primary bibliographic entry see Field 4B. W75-10142

## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

**HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS, 1973,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 7C.  
W75-10149

**VALVE STROKING IN SEPARATED PIPE FLOW,**  
Edinburgh Univ. (Scotland). Dept. of Mechanical Engineering.  
M. Driels.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY11, Paper No 10940, p 1549-1563, November 1974. 12 fig, 34 equ, 9 ref, 4 appen.

Descriptors: \*Valves, \*Hydraulics, \*Water hammer, \*Cavitation, Pipe flow, Piping systems(Mechanical), Air entrainment, Surges, Equations, Simulation analysis, Computer programs, Velocity, Control, Algorithms, Mathematical models.  
Identifiers: Fluid flow, Transients, Prediction, Steady-state pressure, Valve closure, Linear closure, Method of characteristic.

Apart from assessing the magnitude of a pressure surge propagated within a pipe flow system, the engineer needs to be able to reduce the surge, possibly using a process known as valve stroking. Although methods of valve stroking exist, they are not applicable to systems in which flow separation occurs due to the loss of control by the valve on the separated column. Developed are two methods for dealing with such a situation. It is shown that for the first method, a surge reduction of 40% is typical; these results are supported by experimental evidence. The second method indicates that a 95% reduction in the surge is possible, although at present no experimental data are available to confirm this. (Bell-Cornell)  
W75-10210

**TRANSFORMATION OF MOODY DIAGRAM,**  
Haile Selassie I Univ., Addis Ababa (Ethiopia). Dept. of Civil Engineering.  
K. C. Asthana.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol 100, No HY6, Paper No 10624, p 797-808, June 1974. 1 fig, 1 tab, 21 equ, 2 ref.

Descriptors: \*Pipe flow, \*Hydraulics, \*Darcys law, \*Moody resistance diagrams, Headloss, Friction, Equations, Pipes, Size, Velocity.

The Moody diagram has been extensively used for the solution of pipe flow problems. A revised pipe flow diagram between dimensionless parameters is developed based on the transformation of the Moody diagram with the help of the Darcy equation. The revised diagram eliminates the repeated use of the Darcy equation, the friction factor, and the need of successive trials in the solution of pipe flow problems. It provides a more direct, simple, and convenient means of solving pipe flow problems within the range of accuracy expected from the original Moody diagram. (Bell-Cornell)  
W75-10216

**TRANSIENT CONTROL IN LOWER SACRAMENTO RIVER,**  
Bureau of Reclamation, Sacramento, Calif. Applications Branch.  
For primary bibliographic entry see Field 4A.  
W75-10219

**SAFETY OF DAMS—BUREAU OF RECLAMATION,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
For primary bibliographic entry see Field 8A.  
W75-10221

### 8C. Hydraulic Machinery

**MECHANICAL MANAGEMENT OF AQUATIC VEGETATION: ANALYTICAL STUDIES OF UNIT OPERATIONS POTENTIALLY USEFUL IN THEIR PROCESSING,**  
Wisconsin Univ., Madison. Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 4A.  
W75-09861

**GEOOTHERMAL BRINE ENERGY TO GENERATE POWER,**  
Chevron Research Co., San Francisco, Calif. (assignee).

J. R. B. Ellis, and A. W. Pryor.  
U.S Patent No 3,862,545, 3 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 93, No 4, p 1761, January 28, 1975.

Descriptors: \*Patents, \*Geothermal studies, \*Thermal properties, \*Subsurface waters, Brines, Salts, Electric powerplants, Steam turbines, Energy.

A process is described for using energy from a hot brine to generate power. The process consists of flashing the hot brine in a flash zone to form steam and a concentrated brine. The steam is used to drive a power-generating turbine. Exhaust steam from the turbine is condensed. This condensate from the turbine exhaust is combined with the concentrated brine to form a restored brine and consequently the restored brine is returned to the source of the hot brine. Oxygen is excluded from the system to minimize corrosion. The flash zone contains at least one flash drum and preferably the hot brine is flashed without any substantial crystallization of the soluble salts. (Sinha-OEIS)  
W75-09863

**REVERSE OSMOSIS SYSTEM WITH AUTOMATIC VALVE FOR MODULE OPERATION CONTROL,**  
Desalination Systems, Inc., Escondido, Calif. (assignee)

For primary bibliographic entry see Field 3A.  
W75-09877

**VALVE STROKING IN SEPARATED PIPE FLOW,**  
Edinburgh Univ. (Scotland). Dept. of Mechanical Engineering.  
For primary bibliographic entry see Field 8B.  
W75-10210

**CALIFORNIA PLANT GETS STRAIGHT 'A'S IN COMPUTER CONTROL,**  
San Jose-Santa Clara Water Pollution Control Plant, San Jose, Calif.  
For primary bibliographic entry see Field 5D.  
W75-10264

**SUBMERSIBLE PUMPS MAKE BY-PASS POSSIBLE,**  
Los Angeles County Sanitation District, Whittier, Calif.  
J. A. Redner, and J. E. Kenmir.  
Water and Wastes Engineering, Vol 12, No 4, p 62, 64, April, 1975.

Descriptors: \*Pumps, Valves, Pipes, Flood control, Equipment, Installation, Sewerage, \*Waste water treatment, \*California.  
Identifiers: \*Los Angeles County(Calif), Submersible pumps, Pumping stations.

Five submersible pumps in Los Angeles County, California, have been installed to provide emergency by-pass of waste water pumping stations. This installation was in response to a flooding in 1972 when power was lost and waste water from a

wet well flooded the pump house. Portable submersible pumps were chosen because of operating reliability. Of the pumping stations in the Los Angeles district, 23 have volume and head conditions in the correct range for high-capacity electric submersible pumps. Of these stations, conditions range from 9000 gpm at 26 feet to 1200 gpm at 150 feet. Extreme emergency conditions would require two pumps in parallel to handle the flow. The pumps ordered consist of two 30 hp Flygt Model CS 3200, two 77 hp High Volume Flygt Model CS 3300, and one 88 hp High Head Flygt Model CS 3300. In an emergency, a pump will be rushed by truck to the disabled pump station. A quick coupling discharge pipe can be connected to a flanged fitting on the pump and the pump and discharge pipe will be lowered into a pumping manhole along guide rails. The free end of the aluminum discharge pipe will then be connected to a permanently installed force main connection pipe using a victaulic coupling. The entire connection operation should average only thirty minutes before actual by-pass pumping begins. (Prague-FIRL)  
W75-10276

**WASTEWATER LIFT STATION OPENS WAY TO URBAN EXPANSION.**  
The American City, Vol 90, No 3, p 59-60, March, 1975.

Descriptors: \*Pumps, Sewerage, Installation, Sewage treatment, Maintenance, Equipment, Waste water treatment, Illinois.  
Identifiers: \*Pump stations, Homewood(Ill).

A pre-engineered underground pump station was built and installed in Homewood, Illinois in order to control the sewerage system of an expanding residential development. This lift station is capable of transferring up to 8.3 mgd of sewage collected from the annexed area to the Homewood receiving line. The station has three pumps, with two of these already put into operation. Sewage will flow into a 4000 gallon wet well; as this well fills, back pressure on a compressor-operated air bubbler increases until a mercury pressure switch is actuated. At a pre-determined level, the switch energizes one of the two pumps. The mercury pressure of each pump is set so that both pumps may operate during periods of maximum flow, distributing their work evenly. The pumps then discharge the sewage through a check valve and a discharge gate valve to a force main; the sewage then flows by gravity for another one and one quarter miles to the treatment plant. Each pump is rated at 4200 gpm against a total dynamic head of 38 feet and is driven by 60 hp, 875 rpm electric motors. Only a six-week installation period was required for the entire station, which arrived pre-constructed from Ecodyne in Kansas. Thus far, maintenance has been minimal, and records of meter readings are kept daily. (Prague-FIRL)  
W75-10277

**MINUTES OF THE 89TH MEETING, (ARKANSAS-RED-WHITE RIVER BASINS INTER-AGENCY COMMITTEE).**  
Arkansas-White-Red Basins Inter-Agency Committee, Wichita, Kans.  
For primary bibliographic entry see Field 4A.  
W75-10300

**DURABLE SLURRY PUMPS ARE HEART OF POLLUTION CONTROL FACILITY AT IN-LAND.**  
Iron and Steel Engineer, Vol 52, No 4, p 97-98, April, 1975. 2 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, Pumps, Filtration, Treatment facilities, Water quality control, Chlorination, Cooling towers, Filters, Hydrogen ion concentration.  
Identifiers: Steel mills, pH control, Biocide addition.

## ENGINEERING WORKS - Field 8

### Fisheries Engineering - Group 8I

Inland Steel Company's continuous slab casting facility at Indiana Harbor Works has been in operation for two years. The initial design requirements of maximum quality production and water quality control were fulfilled through the successful implementation of a closed-loop cooling water filtration and treatment plant. Four slurry handling pumps act as filtration unit feed pumps and as filtration media scrubbing pumps at different times in the sequence of the 24 hr filtration cycle. Hydromation Filter Corporation designed and installed the high-performance, in-depth water filtration system. The process involves a deep-bed filter with finely divided permanent filter media. The polluted liquid, often containing up to 200 ppm of hard abrasives mill scale, enters the center of the filter bed and flows radially outward through the filter media. High inlet velocities drive the contaminants into the bed. The pressure and velocity decrease as the liquid passes through the media permitting continuous dirt and particle entrapment. In addition to the filtration, treatment comprises chlorination, pH control, biocide addition, and a pass through a cooling tower. (Orr-FIRL) W75-10340

#### THE COMPARISON OF THE ENVIRONMENTAL ASPECTS OF NUCLEAR AND FOSSIL FUELLED POWER STATIONS, New South Wales Univ., Kensington (Australia). School of Nuclear Engineering.

Z. J. Holy.

Available from the National Technical Information Service, Springfield, Va 22161 as Rept No Conf 740555, \$4.00 in paper copy, \$2.25 in microfiche. May 20, 1974. p 153-161, 2 tab, 10 fig, 13 ref.

Descriptors: \*Nuclear powerplants, \*Nuclear energy, \*Fossil fuels, \*Electric powerplants, \*Comparative benefits, \*Effluents, \*Radioactivity, Air pollution, Water pollution, Soil contamination, Environmental effects, Human population, Thermal pollution, Public health, Coals, Sulfur. Identifiers: Fuel reprocessing.

Two of the major problems facing our society today are the growing demands for energy and the pollution associated with its generation. World reserves of fossil fuels alone will not meet these demands, and it is obvious that other power sources, such as nuclear fission, must supplement the combustion processes currently used. In this paper, the major environmental hazards associated with both fossil fuelled and nuclear power stations are discussed, using data both from Australia and overseas. The environmental and biological effects of air pollution, thermal pollution, radioactive effluent from power stations and fuel reprocessing plants, and radioactive waste disposal are dealt with, and the safety of nuclear power stations discussed. Two methods are outlined for the comparison of hazards associated with fossil fired and nuclear plants, and one of these is used in the analysis. The paper is not intended to provide an exhaustive study of the subject, but rather to indicate the major points of concern and to illustrate a possible approach using a simple model for such environmental comparisons. (Houser-ORNL) W75-10349

#### 8D. Soil Mechanics

##### ENGINEERING UTILITY AND SEWAGE LINES IN PERMAFROST SOIL, For primary bibliographic entry see Field 5D. W75-10192

##### SOIL LIQUEFACTION BY TORSIONAL SIMPLE SHEAR DEVICE, Washington Univ., Seattle. Dept. of Civil Engineering. I. Ishibashi, and M. A. Sherif.

Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 100, No GT8, p 871-888, August 1974. Paper 10752. 19 fig, 4 tab, 4 ref.

Descriptors: \*Soil liquefaction, \*Shear, \*Measurement, Stress, Earthquakes, Shear device, Laboratory tests, Equipment. Identifiers: \*Torsional simple shear device.

As a result of severe earthquakes, structural damage due to soil liquefaction has become an area of study in many research laboratories. A simple shear device, the conventional equipment for liquefaction laboratory study, has several difficulties. A new instrument eliminates such effects as wall friction without sacrificing requirements of duplicating in situ stress and strain conditions. The new instrument called the Torsional Simple Shear Device, was compared with the simple shear test equipment. It was found that with the Torsional Simple Shear Device one can check and verify the adequacy of the amount of soil saturation prior to cyclic testing and one can study the effects of lateral soil confinement on the liquefaction potential of the test sample. In addition, the Torsional Simple Shear Device tests the soil with a unique cross-sectional area and imposes uniform shear strains and stresses, thus providing more reliable experimental results. (Prague-FIRL) W75-10231

#### BIG HILL LAKE CREEK, KANSAS (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Tulsa, Okla.

Available from the National Technical Information Service, Springfield, Va 22161 as USDC, EIS-KS-73-1621-F, \$8.50 in paper copy, \$2.25 in microfiche. October 11, 1973. 271 p, multiple tab, multiple map.

Descriptors: \*Multiple-purpose reservoirs, \*Environmental effects, \*Kansas, \*Dam construction, \*Earth dams, Watershed management, Watersheds(Basins), Water supply development, Water supply, Flood protection, flood plains, Flooding, Engineering structures, Multiple-purpose projects, Artificial lakes, Federal government, Water conservation, Wildlife habitats, Recreation, Embankments, Impoundments, Flood control.

This project is located on Big Hill Creek in southern Kansas and calls for the construction of a lake for flood control, water supply, and recreation. A 4,425-foot long earthen embankment will be constructed creating a lake having a capacity of 40,600 acre-feet at the top of the flood pool. The project site is a predominantly agricultural and rural area. Construction of the lake will largely eliminate flood damage in the area below the dam and will provide 8.5 million gallons per day of high quality water supply for the next 100 years. 2700 acres of cropland, pasture and woodland will be committed to the project, with 1240 acres inundated by the conservation pool and another 280 acres subject to periodic flooding. 12 miles of stream habitat will be lost and nine archaeological sites will adversely affected. Various combinations of dry lakes and water supply lakes, various flood plain management programs, and no action were among alternatives considered. The project will enhance the long term productivity of the region, and except for construction materials, will require no irretrievable commitment of resources. The area inundated will be committed for the life of the project. There appears to be no significant opposition to this project. (Deckart-Florida) W75-10293

#### TYBEE ISLAND GEORGIA, BEACH EROSION CONTROL PROJECT (FINAL ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4D.  
W75-10294

#### 8I. Fisheries Engineering

##### MARKING ALEWIFE FRY WITH BIOLOGICAL STAINS, Department of the Environment, Halifax, (Nova Scotia). Fisheries Service. B. M. Jessop.

Prog Fish-Cult, Vol 35, No 2, p 90-93, 1973.

Identifiers: \*Alewife, *Alosa-pseudoharengus*, \*Biological stains, Fry, \*Fish marking, Fish handling.

Bismark brown Y was more suitable than neutral red from the immersion staining of young alewives (*Alosa pseudoharengus*). It was less toxic than neutral red and produced an identifiable mark for a longer time. Should the difficulties experienced in handling these fish be overcome, the marking method may be of practical use in population estimates. Copyright 1973, Biological Abstracts, Inc. W75-10029

#### INFLUENCE OF LIGHT INTENSITY ON THE BIOENERGETICS OF CHANNEL CATFISH, Missouri Univ., Columbia.

E. F. McDonald.

Available from the National Technical Information Service, Springfield, Va 22161 as COM-73-11007, \$3.75 in paper copy, \$2.25 in microfiche. MS thesis, May 1973. Report No. NOAA-73052409. 36 p, 2 fig, 5 tab, 11 ref. NOAA 2-164-R.

Descriptors: \*Fish behavior, \*Light intensity, \*Animal physiology, \*Channel catfish, Fish diseases, Animal growth, Productivity, Respiration, Water quality, Growth rates, Metabolism, Aquiculture, Economics, Oxygen requirements.

The primary objective was to measure growth and food conversion of the channel catfish, *Ictalurus punctatus*, as affected by light. Also studied were the behavior, metabolism, feeding, and growth at different light intensities. Investigations were conducted under three light intensities of full, 1/10th full, and negligible. For the larger fish there was significantly greater growth under negligible light intensity. For small fish there was no significant difference between weight gain under different light conditions. Oxygen consumption indicated that for the larger fish the differences between activity curves at each intensity were not great, but the medium intensity curve showed the highest levels of activity. For the small fish oxygen consumption curves indicate that activity pattern of fish under medium and high light intensity were nearly identical except that fish activity under high light intensity appears to be more depressed during the hours of light. Medium and high light curves show the highest levels of activity at 'lights on' and 'lights out' with the lowest levels during the hours of light. Light intensity must be considered only a secondary determinant of success and efficiency in catfish production when compared to the problems associated with pathology; both parasitic and bacterial diseases were evident. (Jones-Wisconsin) W75-10100

ARTIFICIAL REEFS FOR TEXAS.  
Texas A and M Univ., College Station. Industrial Economics Research Div.  
For primary bibliographic entry see Field 3E.  
W75-10119

## Field 9—MANPOWER, GRANTS AND FACILITIES

### Group 9A—Education (Extramural)

#### 9. MANPOWER, GRANTS AND FACILITIES

##### 9A. Education (Extramural)

###### WATER RESOURCES PUBLICATIONS RELATED TO THE STATE OF NEBRASKA THIRD EDITION.

Nebraska Univ., Lincoln. Water Resources Research Inst.  
For primary bibliographic entry see Field 10C.  
W75-10015

###### RECOMMENDATIONS FOR ENVIRONMENTAL ENGINEERING EDUCATION,

Northwestern Univ., Evanston, Ill. Dept. of Civil

Engineering.

W. O. Pipes.

Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 100, No EE2, Paper No 10459, p 243-252, April 1974.

Descriptors: \*Water pollution, \*Water quality control, \*Education, \*Environmental engineering, Land use, Natural resources, Air pollution, Public health, Radiation, Protection, Research, Sanitary engineering, Solid wastes, \*Manpower.

Identifiers: Accreditation, Continuing education, \*Engineering education, Fellowships, Industrial hygiene, Professional advancement, Public works, Refuse disposal.

Presented is a summary and discussion of the recommendations which were put forth at the Third National Conference on Environmental Engineering Education held at Drexel University, Philadelphia, in August 1973. Reports and proposed recommendations were originally developed by seven committees in preparation for the Conference. The proposed recommendations were discussed and modified and some were adopted at the Conference. The recommendations are concerned with the identity of the manpower needs for, and educational programs for environmental engineering. A large number of civil engineers and some engineers with other educational backgrounds have identified with environmental engineering as a field of practice. The field is broad because it is concerned with protecting human populations from environmental hazards and with protecting environments from the effects of human activities. (Bell-Cornell)  
W75-10218

###### TENTH ANNUAL REPORT, FISCAL YEAR 1974,

Auburn Univ., Ala. Water Resources Research Inst.

For primary bibliographic entry see Field 9D.

W75-10339

##### 9D. Grants, Contracts, and Research Act Allotments

###### WATER RESOURCES PUBLICATIONS RELATED TO THE STATE OF NEBRASKA THIRD EDITION.

Nebraska Univ., Lincoln. Water Resources Research Inst.

For primary bibliographic entry see Field 10C.

W75-10015

###### TENTH ANNUAL REPORT, FISCAL YEAR 1974,

Auburn Univ., Ala. Water Resources Research Inst.

J. C. Warman.

1974. 69 p, 1 fig, 19 photo, 1 tab, 38 ref. OWRT A-999-ALA(3).

Descriptors: \*Alabama, \*Water quality control, \*Water resources development, \*Water supply development, Agriculture, Water pollution, Water, Water quality, Water quality standards, Water resources, Water supply, Water conservation, Water pollution control, Water pollution effects, Water pollution sources, Water pollution treatment, Pollutant identification, Pollutants, Pollution abatement, Waste water(Policy), Waste water treatment, Wastes, Waste treatment, Waste water disposal.  
Identifiers: Hazardous substances(Pollution).

Alabama's most pressing water problems are in the area of water quality management and protection and in water resources planning. Other problem areas highlighted by the state's new Water Resources Research Advisory Committee are included in the categories of water cycle and water supply augmentation and conservation. Principal areas considered include: the nature of water, the water cycle, conservation in agriculture, identification of pollutants, sources and fate of pollution, the effects of pollution, waste treatment processes, ultimate waste disposal, water quality control, techniques of planning, evaluation processes, cost allocation, cost sharing, and pricing and repayment. (Gagliardi-Florida)  
W75-10339

#### 10. SCIENTIFIC AND TECHNICAL INFORMATION

##### 10C. Secondary Publication And Distribution

###### HUMAN RADIATION DOSE STUDIES. A SELECTED BIBLIOGRAPHY.

Technical Information Center (AEC), Oak Ridge, Tenn.

For primary bibliographic entry see Field 5A.

W75-09890

###### TERRESTRIAL AND FRESHWATER RADIOCOLOGY, A SELECTED BIBLIOGRAPHY,

Washington State Univ., Pullman. Dept. of Zoology.

For primary bibliographic entry see Field 5A.

W75-09891

###### REVIEW OF LITERATURE PERTINENT TO THE AQUEOUS CONVERSION OF RADIONUCLIDES TO INSOLUBLE SILICATES WITH SELECTED REFERENCES AND BIBLIOGRAPHY (REVISED),

Atlantic Richfield Hanford Co., Richland, Wash.

For primary bibliographic entry see Field 5D.

W75-09892

###### BIBLIOGRAPHY ON THE APPLICATION OF REVERSE OSMOSIS TO INDUSTRIAL AND MUNICIPAL WASTEWATERS,

Department of the Environment, Ottawa (Ontario). Waste Water Technology Centre.

For primary bibliographic entry see Field 5D.

W75-09925

###### WATER RESOURCES PUBLICATIONS RELATED TO THE STATE OF NEBRASKA THIRD EDITION.

Nebraska Univ., Lincoln. Water Resources Research Inst.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-243 778, \$5.25 in paper copy, \$2.25 in microfiche. Publication No 7, May 1975, 100 p. OWRT A-999-NEB(16) 14-31-0001-5027.

Descriptors: \*Bibliographies, \*Publications, \*Nebraska, \*Information exchange, State govern-

ments, Federal government, Universities, Organizations, Coordination, \*Water resources.

This is the third edition of 'Water Resources Publications Related to the State of Nebraska' which lists water-related publications from Nebraska state, federal and university agencies and departments. The material provided should facilitate the exchange of information between the various organizations interested in Nebraska's waters. Complete author and key word indexes are contained in this third edition. Listings are cross-referenced whenever practical. The Table of Contents indicates major subdivisions of the bibliography: Federal agencies, State agencies, University of Nebraska, Chadron State College, Lower Plate South Natural Resources District, and Missouri River Basin Commission. (Stork-Nebraska)  
W75-10015

###### SURFACE WATER DATA, REFERENCE INDEX, CANADA 1974.

Water Survey of Canada, Ottawa (Ontario).

For primary bibliographic entry see Field 07C.

W75-10064

###### IRRIGATION EFFICIENCIES IN PRODUCING CALORIES AND PROTEINS: AN ANNOTATED BIBLIOGRAPHY,

California Univ., Los Angeles. School of Public Health.

For primary bibliographic entry see Field 03F.

W75-10076

###### OZONE CHEMISTRY AND TECHNOLOGY-A REVIEW OF THE LITERATURE: 1961-1974,

Franklin Inst. Research Labs., Philadelphia, Pa.

Science Information Services Dept.

For primary bibliographic entry see Field 05D.

W75-10348

##### 10D. Specialized Information Center Services

###### SURVEY OF LAKE REHABILITATION TECHNIQUES AND EXPERIENCES,

Wisconsin Dept. of Natural Resources, Madison.

For primary bibliographic entry see Field 05C.

W75-10078

##### 10F. Preparation Of Reviews

###### RAIN ENHANCEMENT - A REVIEW,

Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Cloud Physics.

For primary bibliographic entry see Field 03B.

W75-09950

###### UPGRADING EXISTING WASTEWATER TREATMENT PLANTS—CASE HISTORIES.

Environmental Protection Agency, Washington, D.C. Technology Transfer Staff.

For primary bibliographic entry see Field 05D.

W75-10347

###### OZONE CHEMISTRY AND TECHNOLOGY-A REVIEW OF THE LITERATURE: 1961-1974,

Franklin Inst. Research Labs., Philadelphia, Pa.

Science Information Services Dept.

For primary bibliographic entry see Field 05D.

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## **CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE**

- Ground and surface water hydrology at the Illinois State Water Survey and the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

### **Supported by the Environmental Protection Agency in cooperation with WRSIC**

- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

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